VOLUME 14 NUMBER 24/DECEMBER 23, 1976

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N76-33128* + National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 73, AUGUST 1976
Aug. 1976 73 p
(NASA-SP-7037(73)) Avail: NTIS HC $4.00 CSCL 01A

This bibliography lists 206 reports, articles, and other documents introduced into the NASA scientific and technical information system in July 1976. Author

N76-33129*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ELEMENTARY APPLICATIONS OF A ROTORCRAFT DYNAMIC STABILITY ANALYSIS
Wayne Johnson Jun. 1976 24 p refs Prepared in cooperation with Army Air Mobility Research and Development Lab., Moffett Field, Calif.
(NASA-TM-X-73161; A-6717) Avail: NTIS HC $3.50 CSCL 01C

A number of applications of a rotorcraft aeroelastic analysis are presented to verify that the analysis encompasses the classical solutions of rotor dynamics, and to examine the influence of certain features of the model. Results are given for the following topics: flapping frequency response to pitch control; forward flight flapping stability; pitch/flap flutter and divergence; ground resonance instability; and the flight dynamics of several representative helicopters. Author

N76-33130# Advisory Group for Aerospace Research and Development, Paris (France).
AGARD BULLETIN: TECHNICAL PROGRAM, 1977
Jul. 1976 37 p
(AGARD-Bull-76-2) Avail: NTIS HC $4.00

The AGARD technical program for 1977 approved by the national delegates board was presented. The following information is given: chronological listing of meetings tentatively scheduled to take place, detailed description of the individual panel programs, consultant and exchange program, and military committee studies program, total budget required, and publications summary. Author

N76-33131# Committee on Science and Technology (U. S. House).
THE FUTURE OF AVIATION, VOLUME 1
Washington GPO 1976 110 p refs Rept. for Comm. on Sci. and Technol., 94th Congr., 2d Sess., Oct. 1976
(GPO-72-600) Avail: SOD HC $1.40

A number of findings and recommendations relative to the future of the aviation industry in the United States are presented. These are primarily focussed on the following points, oriented on the need to: (1) maintain the U.S. preeminence in aeronautics, (2) set-up a national civil R and D policy, (3) restructure and reorient government sponsored R and D and demonstration programs and activities with those related to other modes of transportation, (4) accelerate application of new technology, (5) expand federally-sponsored civil R and D and demonstration efforts to compensate for reduced military fall-out, (6) improve ability of U.S. air carriers to purchase new equipment, (7) have the Department of Transportation act as a focus for civil aviation R and D, (8) setting-up a strong centralized policy-level authority, (9) assist the U.S. aircraft industry in developing new generation aircraft, (10) reduce the recent emphasis on joint ventures with foreign manufacturers through some form of government assistance, (11) increase operating efficiency of aircraft. Y.J.A.

N76-33132# Committee on Science and Technology (U. S. House).
THE FUTURE OF AVIATION, VOLUME 2
Washington GPO 1976 105 p refs Compilation of papers for Comm. on Sci. and Technol., 94th Congr., 2d Sess., Oct. 1976
(GPO-77-667) Avail: SOD HC $1.35

A number of papers intended to support 'The future of aviation, Volume 1', are presented. These deal with the organization for aviation and a description of the R & D facilities of FAA and NASA. Y.J.A.

N76-33133*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL EFFECTS OF FUSELAGE CAMBER ON LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF A SERIES OF WING-FUSELAGE CONFIGURATIONS AT A MACH NUMBER OF 1.41
Samuel M. Dollyhigh, Odell A. Morris, and Mary S. Adams Washington Oct. 1976 27 p refs
(NASA-TM-X-3411; L-10847) Avail: NTIS HC $4.00 CSCL 01A

An experimental investigation was conducted to evaluate a method for the integration of a fighter-type fuselage with a theoretical wing to preserve desirable wing aerodynamic characteristics for efficient maneuvering. The investigation was conducted by using semispan wing fuselage models mounted on a splitter plate. The models were tested through an angle of attack range at a Mach number of 1.41. The wing had a leading edge sweep angle of 50 deg and an aspect ratio of 2.76; the wing camber surface was designed for minimum drag due to lift and was to be self trimming at a lift coefficient of 0.2 and at a Mach number of 1.40. A series of five fuselages of various camber was tested on the wing. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N76-33134*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PASSENGER RIDE COMFORT TECHNOLOGY FOR TRANSPORT AIRCRAFT SITUATIONS
William Conner and Ira D. Jacobson Oct. 1976 24 p refs
(NASA-TM-X-73953) Avail: NTIS HC $3.50 CSCL 05E

Research in ride comfort and of the resultant technology is overviewed. Several useful relations derived from the technology are: input environments to the vehicle; aircraft operations; and aircraft configurations. Input environments which influence the ride motion environment consist of naturally occuring phenomena such as gusts or turbulence and man generated phenomena such as trailing vortex wakes or runway roughness. Aircraft operations influence ride environments in the form of motions caused by maneuvers, of pressure changes caused by rapid descents, or of too high temperature. Aircraft configurations influence the ride environment by size and shape of external surfaces which generate aerodynamic perturbing forces; by onboard equipment, such as power plant noise and vibrations; and by passive equipment which directly interfaces the passengers such as marginal size seats with limited elbowroom and legroom. S.M.

N76-33135*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AERODYNAMIC PERFORMANCE OF A 1.20-PRESSURE RATIO FAN STAGE DESIGNED FOR LOW NOISE
George W. Lewis, Jr. and Royce D. Moore Washington Oct. 1976 113 p refs
(NASA-TM-X-3430; E-8575) Avail: NTIS HC $5.50 CSCL 21E

The aerodynamic design and the overall blade element performance of a 51 centimeter diameter fan stage is presented. The stage was designed to minimize the noise generated by rotor stator interactions. The design pressure ratio was 1.20 at a flow of 30.6 kilograms per second and a rotor blade tip speed of 228.6 meters per second. At design speed the rotor peak efficiency was 0.935. The peak efficiency of the stage, however, was 0.824. The radial distribution of rotor performance parameters at peak efficiency and design speed indicated excellent agreement with design values. Author

N76-33136*# Scientific Translation Service, Santa Barbara, Calif.
A CRITIQUE OF TRANSONIC AEROFOIL TESTING TECHNIQUES
M. Bazin, R. Bernard-Guelle, and J. Ponteziere Washington NASA 26 Oct. 1976 49 p refs Transl. into ENGLISH from Aeronaut. Astronaut. (Paris), no. 31, 1971 p 69-76 and no. 32, 1971 p 41-52 Presented at the 7th Appl. Aerodynamic Colloq. of the AFITAE, Lyon, France, 4-5 Nov. 1970
(Contract NASw-2791)
(NASA-TT-F-17251) Avail: NTIS HC $4.00 CSCL 01A

Research on new transonic airfoil sections in two dimensional wind tunnel flow is being reported. The Modane set-up is harnessed to industrial uses. It is suited for tests on large scale models over an extensive Reynolds number range. Experiments on helicopter blade members of equal chord with the rotor blades tested in the S1MA tunnel provided a basis for comparison of two dimensional flow and rotor. The R1 tunnel was the scene of systematic investigations into wall interactions as the key to a full knowledge of the aerodynamic coefficients. The first results suggest some correctives to testing conditions in this wind tunnel. Author

N76-33137*# Kanner (Leo) Associates, Redwood City, Calif.
HYDRAULIC RESISTANCE OF NONCIRCULAR SECTION CHANNELS
I. S. Riman and T. K. Aksenova Washington NASA Oct. 1976 12 p refs Transl. into ENGLISH from Promyshlennaya aerodinamika, (Moscow), issue 31, 1974, p 155-162
(Contract NASw-2790)
(NASA-TT-F-17256) Avail: NTIS HC $3.50 CSCL 01A

Results are presented of an experimental determination of the aerodynamic drag coefficients of hexagonal cross-section annular ducts and of channels obtained by deconvolution of eccentric circular annular ducts. Graphs illustrate the dependence of drag coefficients (for air flows) on the Reynolds number in the deconvoluted eccentric circular annular duct and in six hexagonal-section annular ducts with varying eccentricity of the inner wall. The concentric hexagonal annular ducts exhibit about 9% less drag than circular pipes at identical Reynolds numbers. Eccentric displacement of the inner wall can produce up to 25% reduction of drag in the hexagonal annular duct, with maximum drag reduction resulting from displacement toward an angle rather than toward a flat wall segment. Channels produced by deconvolution of circular eccentric annular ducts also show less drag than pipes at identical Reynolds numbers. Author

N76-33138*# General Dynamics/Fort Worth, Tex.
A STEADY AND OSCILLATORY KERNEL FUNCTION METHOD FOR INTERFERING SURFACES IN SUBSONIC, TRANSONIC AND SUPERSONIC FLOW
Atlee M. Cunningham, Jr. 30 Sep. 1976 138 p refs
(Contract NAS1-12399)
(NASA-CR-144895) Avail: NTIS HC $6.00 CSCL 01A

The theory, results and user instructions for an aerodynamic computer program are presented. The theory is based on linear lifting surface theory, and the method is the kernel function. The program is applicable to multiple interfering surfaces which may be coplanar or noncoplanar. Local linearization was used to treat nonuniform flow problems without shocks. For cases with imbedded shocks, the appropriate boundary conditions were added to account for the flow discontinuities. The data describing nonuniform flow fields must be input from some other source such as an experiment or a finite difference solution. The results are in the form of small linear perturbations about nonlinear flow fields. The method was applied to a wide variety of problems for which it is demonstrated to be significantly superior to the uniform flow method. Program user instructions are given for easy access. Author

N76-33139*# Aeronautical Research Associates of Princeton, Inc., N.J.
ESTIMATES OF THE LOW-LEVEL WIND SHEAR AND TURBULENCE IN THE VICINITY OF KENNEDY INTERNATIONAL AIRPORT ON 24 JUNE 1975
W. S. Lewellen and Guy G. Williamson Washington NASA Oct. 1976 48 p refs
(Contract NAS8-31380)
(NASA-CR-2751; M-183) Avail: NTIS HC $4.00 CSCL 04B

A study was conducted to estimate the type of wind and turbulence distributions which may have existed at the time of the crash of Eastern Airlines Flight 66 while attempting to land. A number of different wind and turbulence profiles are predicted for the site and date of the crash. The morning and mid-afternoon predictions are in reasonably good agreement with magnitude and direction as reported by the weather observer. Although precise predictions cannot be made during the passage of the thunderstorm which coincides with the time of the accident, a number of different profiles which might exist under or in the vicinity of a thunderstorm are presented. The profile that is most probable predicts the mean headwind shear over 100 m (300 feet) altitude change and the average fluctuations about the mean headwind distribution. This combination of means and fluctuations leads to a reasonable probability that the instantaneous headwind shear would equal the maximum value reported in the flight recorder data. Author

N76-33140*# Aeronautical Research Associates of Princeton, Inc., N.J.
WIND SHEAR AND TURBULENCE AROUND AIRPORTS
W. S. Lewellen and Guy G. Williamson Washington NASA Oct. 1976 86 p refs
(Contract NAS8-31380)
(NASA-CR-2752; M-185) Avail: NTIS HC $5.00 CSCL 04B

A two part study was conducted to determine the feasibility of predicting the conditions under which wind/turbulence environments hazardous to aviation operations exist. The computer model used to solve the velocity temperature, and turbulence distributions in the atmospheric boundary layer is described, and the results of a parameteric analysis to determine the expected range of wind shear and turbulence to be encountered in the vicinity of airports are given. The second part describes the delineation of an ensemble of aircraft accidents in which low level wind shear and/or turbulence appeared to be causative

factors. This set of accidents, encompassing a wide range of meteorological conditions, should prove useful in developing techniques for reconstructing hazardous wind environments for aircraft safety investigation purposes. Author

N76-33141*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A TOW CONCEPT FOR THE SPACE SHUTTLE ORBITER APPROACH AND LANDING TEST
Tom F. Bonner, Jr. and Joseph D. Pride, Jr. 24 Aug. 1976 33 p refs
(NASA-TM-X-73972) Avail: NTIS HC $4.00 CSCL 01A

The tow concept provides the means for evaluating the orbiter aerodynamic performance and handling qualities in the same configuration as expected in actual space shuttle flight operation. A Boeing 747-100 aircraft has engine-out capability to tow the orbiter to an altitude that permits a safe orbiter approach and landing. The tow concept also provides a means for conducting a comprehensive ground test program before proceeding into the actual ALT flight operations. The implementation of the tow concept requires only a minor structural modification in the nose section of the orbiter vehicle; requires minor modifications in the 747 cargo bay; and makes use of those orbiter onboard systems installed in the ALT orbiter vehicle. The 747 wake turbulence does not constitute a problem for the orbiter during take-off or climb to altitude. The impact that the tow concept would have on the cost and schedule of the space shuttle program was not evaluated in this study. Author

N76-33142*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
STUDY OF AERODYNAMIC DRAG REDUCTION ON A FULL-SCALE TRACTOR-TRAILER Final Report, Mar.-Dec. 1974
L. L. Steers and L. C. Montoya Apr. 1976 57 p refs
(Contract DOT-TSC-RA-74-31)
(NASA-CR-148806; PB-254571/3; DOT-TSC-OST-76-13) Avail: NTIS HC $4.50 CSCL 13F

Aerodynamic drag tests were performed on a tractor trailer combination using the coast-down method on a smooth, nearly level runway. The tests included an investigation of drag reduction obtained with add on devices that are commercially available or under development. The tests covered tractor trailer speeds ranging from approximately 35 to 65 miles per hour and included fuel consumption measurements. The study shows the effects of the various add on devices on the aerodynamic drag, and for some devices on the fuel consumption. Results from a simulation of fuel consumption tests using a computer program are also included. GRA

N76-33143*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THEORETICAL AND EXPERIMENTAL STUDY OF TWISTED AND CAMBERED DELTA WINGS DESIGNED FOR A MACH NUMBER OF 3.5
Russell B. Sorrells, III and Emma Jean Landrum Washington Aug. 1976 238 p
(NASA-TN-D-8247; L-10823) Avail: NTIS HC $8.00 CSCL 01A

Data are provided for the evaluation of the aerodynamic performance of a series of twisted and cambered delta wings designed for a Mach number of 3.5. Systematic force and pressure data are also presented for comparison with theory. Force tests were made at Mach numbers of 2.3, 3.0, 3.5, 4.0, and 4.6. Design lift coefficients of 0.0 and 0.1 were employed on the 55 deg and 68 deg sweep wings, and design lift coefficients of 0.0, 0.05, and 0.1 were employed on the 76 deg sweep wings. Pressure tests were conducted on the 55 deg and 76 deg sweep flat wings and on the 0.1 design lift coefficient 76 deg sweep wing. The results indicate that for the sweep angles tested, an increase in the zero-lift pitching-moment coefficient is the primary benefit of twist and camber at a Mach number of 3.5. Comparison of the experimental results with results obtained from several lift theories indicates that the Carlson-Middleton linear theory method gave the best overall agreement. The pressure data indicate, however, that there is a cancellation of error at high angle of attack where the lower surface pressures are significantly underpredicted over the inboard region of the wing and where the upper and lower surface pressures are overpredicted over the outboard region of the wing. Author

N76-33144*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COOLED-TURBINE AERODYNAMIC PERFORMANCE PREDICTION FROM REDUCED PRIMARY TO COOLANT TOTAL-TEMPERATURE-RATIO RESULTS
Louis J. Goldman Washington Oct. 1976 43 p refs
(NASA-TN-D-8312; E-8600) Avail: NTIS HC $4.00 CSCL 21E

The prediction of the cooled aerodynamic performance, for both stators and turbines, at actual primary to coolant inlet total temperature ratios from the results obtained at a reduced total temperature ratio is described. Theoretical and available experimental results were compared for convection film and transpiration cooled stator vanes and for a film cooled, single stage core turbine. For these tests the total temperature ratio varied from near 1.0 to about 2.7. The agreement between the theoretical and the experimental results was, in general, reasonable. Author

N76-33145# Politecnico di Torino (Italy). Ist. di Macchine e Motori per Aeromobili.
ANALYSES OF UNSTEADY MOTION IN SUPERSONIC DYNAMIC INLETS OF THE CONVERGENT/DIVERGENT PERFORATED WALL TYPE [ANALISI DEL MOTO NON STAZIONARIO IN PRESE DINAMICHE SUPERSONICHE DI TIPO CONVERGENTE-DIVERGENTE A PARETI PERFORATE]
Luca Zannetti Feb. 1975 38 p refs In ITALIAN
(Publ-168) Avail: NTIS HC $4.00

A convergent-divergent inlet nozzle, the dimensions of which comply with the Evvard and Blakey criterion, was studied under conditions of unsteady flow. The walls are perforated and the hypothesis is made that the current through the holes undergoes a Prandtl-Meyer expansion. Equations of unsteady flow were derived and a numerical integration carried out taking into account boundary values that are detailed. The shock wave is dealt with and three examples of applications are given. ESA

N76-33146# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
A SKIN-FRICTION LAW FOR COMPRESSIBLE TURBULENT BOUNDARY LAYERS BASED ON THE FULL VAN DRIEST TRANSFORMATION
P. Bradshaw Jan. 1976 20 p refs
(Contract MIN-DEF/PE-AT/2037/0133)
(IC-Aero-76-02) Avail: NTIS HC $3.50

The Van Driest inner-layer transformation using the mixing length formulae for velocity and temperature together with the mean-momentum and mean-enthaipy equation has frequently been used successfully to correlate velocity profiles throughout the boundary layer. The use of the Van Driest transformation to relate high-speed velocity profiles to the low speed wall plus wake formulation of Coles yields a C sub f law which can be improved by using velocity profile data. This generalized C sub f formula may be useful in integral methods for arbitrary boundary layers providing C sub f is not significantly affected by upstream variations of wall temperature. Author (ESA)

N76-33147# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.
MEASUREMENT OF THE INTERNAL PERFORMANCE OF A RECTANGULAR AIR-INTAKE AT A MACH NUMBER OF 0.9
C. S. Brown and E. L. Goldsmith London Aeron. Res. Council 1976 43 p refs Supersedes RAE-TR-73020; ARC-34702
(ARC-CP-1346; RAE-TR-73020; ARC-34702) Avail: NTIS HC $4.00; HMSO £1.80; PHI

A rectangular intake having variable geometry compression surfaces and designed for supersonic operation was tested at a Mach number of 0.9 and a Reynolds number based on intake entry height of approximately one million. Tests were made on the intake in isolation and on the side of a fuselage. Maximum mass flow was less than estimates based on geometric throat size. The deficit corresponds to an effective reduction in throat area of about 3%. Critical point pressure recovery was lower than predicted, but the difference can be related to a 'turning

loss' factor as was the case at supersonic speeds. With the compression surfaces on the intake horizontal, performance was unaffected by angle of incidence within the range 0 to 10 deg. With the compression surfaces vertical there was some loss in maximum mass flow and pressure recovery at critical flow conditions at angles of incidence above about 4 deg. This was only partly alleviated by removal of the swept end walls. The presence of the fuselage imposed no obvious effect on the performance of the intake. Author (ESA)

N76-33148# Central Electricity Generating Board, London (England).

NUMERICAL METHODS FOR CALCULATING UNSTEADY FLOWS IN SUBSONIC AND SUPERSONIC TURBOMACHINERY CASCADES

D. E. Hobson Aeron. Res. Council 1976 28 p refs Supersedes ARC-36372

(ARC-CP-1348; ARC-36372) Avail: NTIS HC $4.00; HMSO £1.50; PHI

Two numerical methods are proposed for the prediction of unsteady fluid flows in turbomachinery cascades. Both assume that the unsteady effects are linear and sinusoidal in time and are superimposed on a previously determined, nonuniform steady flow field. In the first method an unsteady velocity potential is used, while in the second the unsteady velocity components and pressure and density perturbations are used in either a differential or integral representation of the unsteady Euler equations of motion. The methods may be used to predict blade flutter effects and the acoustic field generated by interacting rows of blades and may be generalized to deal with three-dimensional flows although only two-dimensional flows are considered here. Some preliminary results for the case of a flat plate cascade operating at zero mean incidence at subsonic and supersonic inlet Mach numbers are presented and compared with existing analytic and numerical solutions. In general the agreement is very good for subsonic cascades; for supersonic ones, difficulty was encountered when trying to enforce the cascades repeat condition. Author (ESA)

N76-33149# Royal Aircraft Establishment, Farnborough (England). Structures Dept.

MEASUREMENTS IN LOW-SPEED FLOW OF UNSTEADY PRESSURE DISTRIBUTIONS ON A RECTANGULAR WING WITH AN OSCILLATING CONTROL SURFACE

D. A. Drane London Aeron. Res. Council 1976 45 p refs Supersedes RAE-TR-70182; RAE-TR-71113; ARC-33080; ARC-33515

(ARC-R/M-3763; RAE-TR-70182; RAE-TR-71113; ARC-33080; ARC-33515) Avail: NTIS HC$4.00; HMSO £3.50; PHI

An experiment made jointly by an Anglo-French team to determine unsteady pressure distributions and forces on a low speed ratio wing with an oscillating control surface is described. Two series of tests were made in the RAE 5-ft-low-speed wind tunnel at frequency parameters between 0.73 and 8.45. The pressure measuring installations were of two types; one consisted of a number of individual transducers, the other employed a series of tubes connected to a single transducer via a pressure switch. The results were compared with calculations based on methods developed at RAE and ONERA. The tests showed that the measuring systems provided results which were in themselves consistent; there were, however, disparities between upper and lower surface oscillatory pressure distributions which made comparisons between theory and experiment difficult. Author (ESA)

N76-33150# British Aircra't Corp., London (England).

EVALUATION OF PRESSURE DISTRIBUTIONS ON THIN WINGS WITH DISTORTED CONTROL SURFACES OSCILLATING HARMONICALLY IN LINEARISED, COMPRESSIBLE, SUBSONIC FLOW. PART 1: DETAILS OF THE PRESSURE DISTRIBUTIONS, AND A SET OF NUMERICAL RESULTS INCLUDING COMPARISONS WITH EXPERIMENT

W. R. Marchbank Aeron. Res. Council 1976 77 p refs Supersedes ARC-35831

(ARC-R/M-3783; ARC-35831) Avail: NTIS HC $5.00; HMSO £4.50; PHI

Details of a method which allows the calculation of converged pressure distributions are presented. The local loading solutions, which were developed from the original work of Landhal were used to extract the discontinuous part of the boundary conditions associated with oscillating control surfaces. The resulting regularized problem was then solved using a lifting surface collocation procedure giving, together with the local solutions, the required pressure distribution. Results using the current theory for a rectangular wing and two swept tapered wings are compared with experiment and other theoretical methods, including the long established 'equivalent modes' technique. Author (ESA)

N76-33151# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Abteilung Ueberschallkanal.

AERODYNAMIC COEFFICIENTS AND POSITION OF THE BOW SHOCK WAVE OF CIRCULAR CONES WITH POINTED AND SPHERICALLY BLUNTED NOSES IN SUPERSONIC FLOW

Hans Emunds 2 Apr. 1976 219 p refs In GERMAN; ENGLISH summary Report will also be announced as translation

(DLR-FB-76-26) Avail: NTIS HC $7.75; DFVLR, Cologne DM 76.20

The aerodynamic coefficients of circular cones with pointed and spherically blunted noses were determined in a 30x30 sq cm supersonic wind tunnel by force and pressure measurements for the Mach number range between 1.57 and 4.15 and for angles of attack of between -3 deg and 5 deg. The cone semiapex angle was varied between 5 deg and 90 deg, and the Reynolds number based on the cone base diameter covered a range of 3.02 million to 5.11 million. At zero incidence the position of the bow shock wave was determined from schlieren and shadow photographs. Author (ESA)

N76-33152# Air Force Systems Command, Wright-Patterson AFB, Ohio.

AERODYNAMICS OF LATTICES IN AN UNSTEADY FLOW, PART 1

D. N. Gorelou, V. B. Kurzin, and V. E. Saren 4 Feb. 1976 284 p refs Transl. into ENGLISH of the book "Aerodinamika reshetok v nestatsionarnom potoke", Novosibirsk, izd-vo Nauka, 1971 p 1-272

(AD-A021303; FTD-ID(RS)T-2482-75-Pt-1) Avail: NTIS CSCL 21/5

The proposed book acquaints the reader with the theory of the unsteady flow of aerodynamic lattices. Interest in this theory is due to the aeroelasticity and unsteady phenomena which limits the power, weight and reliability of turbomachines. GRA

N76-33153# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

AERODYNAMICS OF LATTICES IN AN UNSTEADY FLOW, PART 2

D. N. Gorelou and V. B. Kurzin 4 Feb. 1976 225 p refs Transl. into ENGLISH from the book "Aerodinamika Reshetok v Nestatsionarnom Potoke", Novosibirsk, Izd. Nauka, 1971 p 147-268

(AD-A021304; FTD-ID(RS)T-2482-75-Pt-2) Avail: NTIS CSCL 21/5

The unsteady flow of the gas through lattice has a series of special peculiarities which qualitatively differ the flow pattern of lattice in compressible flow from the corresponding picture in the incompressible fluid. The number of such special peculiarities at the subsonic rates of flow of gas includes the phenomenon of acoustic resonance. Gas in turbomachine as a result of compressibility has the capability to complete natural oscillations in the general case in three directions: radial, axial and circular. If one of the natural frequencies of oscillation of gas coincides with the oscillation frequency of blades, then the forced oscillations of gas can arrive at resonance. GRA

N76-33154# Martin Marietta Aerospace, Orlando, Fla.

AERODYNAMIC METHODOLOGY. BODIES WITH TAILS AT ARBITRARY ROLL ANGLES (TRANSONIC AND SUPERSONIC) Final Report

Gennaro F. Aiello Apr. 1976 282 p refs

(Contract DAAH01-74-C-0621)

(AD-A023425; OR-14145) Avail: NTIS CSCL 20/4

Development and use of empirical methods to predict aerodynamic characteristics of missile body-tail configurations are described. Methods cover the Mach number range of 0.6 to 3.0. Prediction methods cover the individual body and tail bend characteristics over the angle of attack range from 0 to 180 degrees. For body-tail configurations at arbitrary roll angles the applicable angle of attack range is 0 to 45 degrees. All mutual interference effects are accounted for, allowing accurate prediction of forces and center of pressure. Author (GRA)

N76-33155# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.

QUASI-THREE-DIMENSIONAL SUPERSONIC VISCID/INVISCID INTERACTIONS INCLUDING SEPARATION EFFECTS Final Technical Report, Oct. 1972 - Sep. 1975

Veer N. Vatsa and Michael J. Werle Nov. 1975 97 p refs

(Contract F33615-73-C-4014)

(AD-A023414; AFFDL-TR-75-138) Avail: NTIS CSCL 20/4

This study is concerned with viscous/inviscid interactions in two and quasi-three-dimensional supersonic flows with separation. Interaction effects are modeled through the so called 'displacement body concept', wherein it is assumed that the inviscid flow 'sees' an effective body obtained by adding the displacement thickness to the original surface. The governing equations in the viscous region are taken to be the interacting boundary-layer equations and an alternating-direction-implicit (ADI) finite difference scheme is employed to obtain their solution. This technique is applied to the quasi-three-dimensional problems resulting from flow past swept (yawed) and axisymmetric compression surfaces. Detailed distributions of surface pressure, skin friction and heat-transfer are presented for Mach numbers of 2 to 6. It is found that both cross flow and axisymmetric effects are easily accommodated in the solution technique and that the predicted results are in qualitative and quantitative agreement with available experimental data. GRA

N76-33156# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

PROJECTILE AFT-BODY DRAG REDUCTION BY COMBINED BOAT-TAILING AND BASE BLOWING Technical Report, Dec. 1973 - Nov. 1975

L. Michael Freeman and Robert H. Korkegi Feb. 1976 69 p refs

(AF Proj. 7065)

(AD-A023207; AFAPL-TR-75-112) Avail: NTIS CSCL 20/4

An experimental study is made at a Mach number of 3 toward reducing the aft-body drag of a slender projectile configuration by means of boat-tailing and base blowing. Nine aft-body configurations were tested, including boat-tail angles of 0, 3, 6, 9, and 12 degrees, three boat-tail lengths, and three base blowing orifice diameters. Both air and helium at room temperature were used as injection gases. Results show that the largest blowing orifice yields the greatest drag reduction, that considerably smaller mass injection rates are required for helium than for air, and that helium injection gives a greater drag reduction than air. These findings confirm those of other investigations. Maximum aft-body drag reduction was obtained with the 6 degree boat-tail 1-caliber in length. Boat-tailing alone reduced the aft-body drag by as much as 23 percent and base injection alone, by as much as 50 percent. Combination of the two showed possible gains of 60 percent. The aerodynamic flow field of the projectile configuration is fully described. Author (GRA)

N76-33157# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

AN ALTERNATING-DIRECTION-IMPLICIT SOLUTION OF SUBSONIC CASCADE FLOW Interim Report, 15 Jan. - 30 Sep. 1975

Kervyn D. Mach Mar. 1976 48 p refs

(AF Proj. 3066)

(AD-A022773; AFAPL-TR-75-80) Avail: NTIS CSCL 20/4

Two numerical methods --- alternating-direction-implicit (ADI) and Gauss-Seidel -- of solving the partial differential equations of subsonic cascade flow are compared. The ADI method was found to be slower and to offer no advantages of accuracy or computer storage. A stability analysis disclosed the existence of a maximum allowable integration step for the ADI algorithm. Implementation of the ADI method and the inclusion of boundary conditions are described and the computer times required for each facet of the ADI iteration are reported. The study concludes that the ADI algorithm is not a viable approach to this type of problem. Author (GRA)

N76-33158# Rockwell International Science Center, Thousand Oaks, Calif.

WAVE INTERACTIONS IN TRANSONIC AND HYPERSONIC FLOW Final Scientific Report, 1 Dec. 1970 - 30 Nov. 1975

Norman D. Malmuth Jan. 1976 12 p refs

(Contract F44620-71-C-0021)

(AD-A023189; SC506.8FR; AFOSR-76-0040TR; SR-1) Avail: NTIS CSCL 20/4

Studies in the transonic and hypersonic regime of nonlinear flows are summarized. In the approximation of weak three-dimensionality, area rules have been developed which predict aerodynamic efficiencies of 'flat top' conical wingbody combinations consisting of conically subsonic conical bodies mounted on the windward side of hypersonic delta wings. Investigations of the pressure fields and shock waves over these combinations are discussed from the stand-point of cross-flow stagnation singularities. The generalization of these results to non-conical supersonic conical bodies is also indicated. For the former, an extended area rule has been derived indicating that the increment in lift due to body addition depends on an area progressing at successive reflection of a two-dimensional disturbance emanating from the body with the shock. Upper bounds for L/D benefits and optimum fuselage shaping are indicated. In the case of conically supersonic conical bodies, the 'subcritical' area rule is demonstrated to remain valid. Pressure fields for this class of configurations reveal a wave train structure. The reflection coefficients, intensity, and number of reflections are quantified in terms of the supercriticality of the secondary leading edge. For the aspect of the research dealing with transonic flow, asymptotic results for the far field derived for supercritical jet flaps subject to solid tunnel wall interference are also discussed. Author (GRA)

N76-33159# Nielsen Engineering and Research, Inc., Mountain View, Calif.

THE TWO-DIMENSIONAL DEVELOPMENT OF FLOW IN THE PRESENCE OF PERIODIC OR RANDOM FLUCTUATIONS WITH APPLICATION TO THE CALCULATION OF CAVITY TONES Final Report, 1 Oct. 1973 - 30 Sep. 1975

James P. Woolley and Krishnamurty Karamcheti Feb. 1976 98 p refs

(Contract F44620-72-C-0010; AF Proj. 9781)

(AD-A023145; NEAR-TR-111; AFOSR-76-0336TR) Avail: NTIS CSCL 20/4

A method for calculating the spatial development of two-dimensional flows in the presence of small periodic or random disturbances is developed. The method has application to transition from laminar to turbulent flow, the characteristics of turbulence and to noise generation by a flowing fluid. The method was developed out of a need to understand the fluid mechanics of the edgetone phenomenon. Therefore, an application of the analytical approach to a class of edgetones, the cavity tone, is demonstrated, and numerical results are presented and compared with experimental results. A discussion of these results, the current status of solution techniques for the equations involved and suggestions for further development are given. Author (GRA)

N76-33160# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.

LOAD INTRODUCTION INTO PRESSURIZED FILMS Final Report

James L. Rand Dec. 1975 50 p

(Contract NCAR-1-73)

(PB-252385/0; TAMRF-921-7501) Avail: NTIS HC$4.00 CSCL 01C

A numerical method for predicting the distribution of stresses in a superpressure balloon system manufactured from a homogeneous, isotropic, elastic film sufficiently pressurized to prevent geometric instabilities is presented. A computational model of the problem was established in the area of load attachment by considering a rectangular region subjected only to an in plane

load at the corner and neglecting any effects of curvature. The grid size is sufficient to obtain detailed stress distributions in and around seams and load patches. GRA

N76-33161# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A WIND TUNNEL STUDY OF THE EFFECTS OF TRAILING EDGE MODIFICATIONS ON THE LIFT-DRAG RATIO OF A CIRCULATION CONTROLLED AIRFOIL M.S. Thesis
Vayl S. Oxford Dec. 1975 68 p refs
(AD-A023356; GAE/AE/75D-16) Avail: NTIS CSCL 01/1

Wind tunnel tests were conducted to determine the effects of trailing edge modifications on the lift-to-drag ratio of a circulation controlled airfoil. The model was a 20 percent thick, five percent cambered, elliptical airfoil. The airfoil was modified in aft contour, blowing slot position, and blowing angle. A 1.5 inch splitter plate was mounted at the 99 percent chord for all tests. The tests were run at a Reynolds number, based on model chord, of 741,000, while the angle of attack and blowing rate were varied during each test sequence. GRA

N76-33162# Naval Postgraduate School, Monterey, Calif.
THE OSCILLATING JET FLAP
Max F. Plater 5 Mar. 1976 43 p refs Presented at Short Course on High Lift Technol., Tennessee Univ. Space Inst., Tullahoma, 1975
(AD-A022768; NPS-57P176031) Avail: NTIS CSCL 01/3

This document is the written version of a lecture presented in the 1975 Short Course on High Lift Technology at the University of Tennessee Space Institute. GRA

N76-33163# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
AN ANALYTIC AND EXPERIMENTAL STUDY OF THE EFFECTS OF SPLITTER PLATE POSITION ON THE TRAILING EDGE MODIFICATIONS OF A CAMBERED CIRCULATION CONTROLLED ELLIPTICAL AIRFOIL M.S. Thesis
Richard K. DeJonckheere Dec. 1975 86 p refs
(AD-A023354; GAE/AE/75D-12) Avail: NTIS CSCL 01/1

Wind tunnel tests were conducted to determine the effects of splitter plate position on trailing edge modifications of a circulation controlled airfoil. Analytic studies were conducted to determine the feasibility of using a potential flow computer program to predict the results of the wind tunnel tests. The airfoil model was elliptical in shape, 20 percent thick, and had five percent camber. It employed a blowing slot for circulation control and a splitter plate for reduction in mixing losses. Modifications included slot positions on the upper surface of 96 and 97 percent chord, slot angles of -5 and -33 degrees, circular and elliptic aft contours, and splitter plate positions on the lower surface of 99 and 95.3 percent chord. Tests were conducted at a Reynolds number of 740 thousand and blowing momentum coefficients of zero and 0.03. GRA

N76-33164# ARO, Inc., Arnold Air Force Station, Tenn.
STRUT SUPPORT INTERFERENCE ON A CYLINDRICAL MODEL WITH BOATTAIL AT MACH NUMBERS FROM 0.6 TO 1.4
R. C. German AEDC May 1976 289 p refs
(ARO Proj. PF446; ARO Proj. P32P-11A)
(AD-A024473; ARO-PWT-TR-75-110; AEDC-TR-76-40) Avail: NTIS CSCL 01/3

An investigation was conducted in the Aerodynamic Wind Tunnel (1T), with a sting-mounted, ogive-cylinder model and various dummy strut designs, to provide further information on sources of nozzle afterbody (NAB) interference and to determine how incremental changes in afterbody boattail and base pressures are affected by changes in support strut design and location. The investigation also included the effect of changing local wall porosity on the NAB interference. An analysis of pressure data obtained on the model, boattail, base, and tunnel wall surfaces at Mach numbers from 0.6 to 1.4 indicates that interference occurs above Mach 0.99 as the result of disturbances generated by the strut leading edge which are reflected from the tunnel wall to the NAB. This interference can be minimized by using a swept strut; however, the optimum strut sweep angle and strut location is a function of Mach number and NAB geometry.
Author (GRA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N76-33165*# Scientific Translation Service, Santa Barbara, Calif.
TECHNOLOGIES FOR THE AIR TRANSPORT OF TOMORROW
P. Poisson-Quinton Washington NASA Sep. 1976 63 p refs Transl. into ENGLISH of French Rept. ONERA TP-1975-62, 1975
(Contract NASw-2791)
(NASA-TT-F-17177) Avail: NTIS HC $4.50 CSCL 01C

A review of technologies essential to the future cost effective development and implementation of large transport aircraft is presented. Emphasis is placed upon the importance of improved methods of design optimization and qualification testing, including ground and flight simulation techniques. Progress in optimization of lift-drag ratios through reduction of transonic drag, skin friction drag, induced drag, wave drag, and casing/motor interference drag is discussed. The task of developing turbofan engines to meet requirements for economical operation while minimizing noise by use of acoustic insulation and appropriate flight procedures is described. The application of new construction techniques and the use of composites to reduce construction and maintenance costs are considered, together with advancements in systems integration and avionics. Author

N76-33166*# Tennessee Univ. Space Inst., Tullahoma.
EFFECTS OF FOG DROPLETS ON WAKE VORTEX DECAY RATE
T. H. Moulden and Walter Frost Washington NASA Oct. 1976 43 p refs
(Contract NAS8-29584)
(NASA-CR-2758; M-184) Avail: NTIS HC $4.00 CSCL 20D

A simple model for the motion of particles in a laminar line vortex is discussed. The energy required to accelerate a set of these particles was determined and shown to be only a small fraction of the energy content of the vortex flow. It is shown that this energy transfer is unlikely to be sufficient to significantly modify the vortex decay rate. It is further argued that the effect of the particle on the viscous properties of the resulting two phase fluid leads to a slower decay rate than in single phase air flow. However, this conclusion may not necessarily follow for turbulence flows. Results show that the migration of particles to the outer flow results in a redistribution of the velocity profile in the vortex and in a non-uniform two phase viscosity across the core. It is suggested that these effects may accelerate vortex bursting. Author

N76-33167# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
BRIEFS OF ACCIDENTS INVOLVING TURBINE POWERED AIRCRAFT. US GENERAL AVIATION 1974
15 Dec. 1975 67 p
(PB-250514/7; NTSB-AMM-75-14) Avail: NTIS HC $4.50 CSCL 01B

General aviation turbine powered aircraft accidents occurring in 1974 are reported. Included are 100 accident briefs, 26 of which involved fatal accidents. A brief format of the facts, conditions, circumstances, and probable cause(s) for each accident are presented. Additional statistical information was tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot certificate, injuries and cause/factor(s).
Author (GRA)

N76-33168# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
BRIEFS OF ACCIDENTS INVOLVING AERIAL APPLICATION OPERATIONS. US GENERAL AVIATION 1974
15 Dec. 1975 325 p
(PB-250520/4; NTSB-AMM-75-22) Avail: NTIS HC $9.75 CSCL 01B

The publication contains reports of U.S. general aviation

accidents occurring in 1974. The brief format presents the facts, conditions, circumstances and probable cause(s)/factor(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot certificate, injuries and causal/factor(s). GRA

N76-33169# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
BRIEFS OF ACCIDENTS INVOLVING MISSING AND MISSING LATER RECOVERED AIRCRAFT. US GENERAL AVIATION 1974
15 Dec. 1975 106 p
(PB-250516/2; NTSB-AMM-75-18) Avail: NTIS HC $5.50 CSCL 01B
For abstract, see N76-33168.

N76-33170# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
BRIEFS OF ACCIDENTS INVOLVING AMATEUR/HOME BUILT AIRCRAFT. US GENERAL AVIATION 1974
15 Dec. 1975 84 p
(PB-250517/0; NTSB-AMM-75-20) Avail: NTIS HC $5.00 CSCL 01B
For abstract, see N76-33168.

N76-33171# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
BRIEFS OF ACCIDENTS INVOLVING AIR TAXI OPERATIONS. US GENERAL AVIATION 1974
15 Dec. 1975 122 p refs
(PB-250518/8; NTSB-AMM-75-21) Avail: NTIS HC $5.50 CSCL 01B
For abstract, see N76-33168.

N76-33172# Air Force Weapons Lab., Kirtland AFB, N.Mex.
EVALUATION OF THE BIRD-AIRCRAFT STRIKE HAZARDS AT SEYMOUR JOHNSON AFB, NORTH CAROLINA Final Report
John P. Nemergut, Rutherford C. Wooten, Jr., and Robert O. Collum Mar. 1976 40 p refs
(AD-A023222; AFWL-TR-75-161) Avail: NTIS CSCL 01/2
A serious bird-aircraft strike hazard potential exists at Seymour-Johnson Air Force Base, North Carolina. The three problem areas involve flight routes to and at the Dare County Gunnery Range, the base airdrome, and birds roosting in fixed facilities adjacent to the runways. Five National Wildlife Refuges in the area surrounding the gunnery range provide suitable habitat for waterfowl, shorebirds and seabirds. Measures to reduce the hazard potential include: (1) determination and avoidance of airspace of known waterfowl concentrations, shorebird and seabird activity, (2) reducing the attractiveness of environmental features in the airbase environment, (3) population reduction within the fixed facilities, and (4) dispersal of starlings from the airfield using starling distress calls. GRA

N76-33173# Air Force Weapons Lab., Kirtland AFB, N.Mex.
RADAR INVESTIGATIONS OF THE BAT HAZARD TO HIGH PERFORMANCE AIRCRAFT AT RANDOLPH AFB, TEXAS Final Report
L. C. Ireland, V. A. Harris, S. S. Ireland, T. C. Williams, and J. M. Williams Mar. 1976 69 p refs
(AD-A024500; AFWL-TR-75-146) Avail: NTIS CSCL 01/2
During the months of April through October, Mexican free-tailed bats (Tadarida brasiliensis mexicana) are a major cause of T-38 engine failures at Randolph AFB, Texas. The airborne behavior of T.b. mexicana emerging from and returning to the Bracken cave, near Randolph AFB, was observed with both search and height-finding radars. Radar echoes from dense groups of bats covered areas as large as 500 sq km and rose to altitudes of over 3,000 m. Evening bat flights appeared to have three distinct phases of development; exit from the roost and ascent, transition to level flight, and dispersal. In the dispersal phase, the bats usually traveled directly toward Randolph AFB. Bat flights may be grouped into three types on the basis of their vertical distribution. One type, characterized by flight at low altitude, was usually observed on nights when T-38s were damaged. A bat avoidance program, based on real time radar observations, was initiated at Randolph AFB during the summer of 1971 and continued thru 1974. Since the start of the program, the frequency of strikes has decreased. It appears possible to predict nights when bat strikes are most likely to occur 24 hours in advance. Strobe lights were found to be an ineffective bat deterrent. GRA

N76-33174# DOD Aircraft Ground Fire Suppression and Rescue Office, Wright-Patterson AFB, Ohio.
CONCEPT STUDY: FEASIBILITY OF CHARACTERIZING AIRFIELD FIRE HAZARDS AND OF DEVELOPING ASSIGNMENT CRITERIA FOR FIRE SUPPRESSION RESOURCES Final Report, Oct. 1974 - Jun. 1975
Wayne E. Kirby and Bertrand F. Ruggles Feb. 1976 49 p refs
(AF Proj. 414F)
(AD-A024449; DOD-AGFSRS-76-4) Avail: NTIS CSCL 01/2
This report presents the results of a project that was undertaken to correlate aircraft fire hazards aground with some quantified airfield parameters involving aircraft operations. The objectives of this study were to explore the feasibility of: (1) correlating aircraft accident/incident history data with airfield operations data in order to characterize aircraft fire hazards which exist in aircraft operations on airfields and (2) developing the criteria needed to assign crash fire suppression equipment to airfields in a manner that reflects the level of an aircraft fire hazard which exists at a given airfield and the capability of specific equipment to deal with the hazards that actually exist. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N76-33175# Transportation Systems Center, Cambridge, Mass.
THE DEVELOPMENT OF AN ATCRBS MONOPULSE MEASUREMENT CAPABILITY AT THE TRANSPORTATION SYSTEMS CENTER, FISCAL YEAR 1974 Interim Report, Fiscal Year 1974
Robert M. Weigand May 1976 58 p refs
(AD-A026959/7; DOT-TSC-FAA-75-14; FAA-RD-76-44) Avail: NTIS HC $4.50 CSCL 17/7
An experimental facility was established to demonstrate the potential of monopulse in an ATC environment. The components of the facility are described and a functional description of the monopulse receiver used in the first year's effort is presented. An error analysis defined the measurement accuracy possible in using the monopulse receiver. Results of two experiments are also presented. The first shows the monopulse accuracy degradation due to receiver noise for targets at an equivalent of a 200 nmi range; the second graphically demonstrates the effect of interference on target location capability. Recommendations for a follow on activity are presented. Author

N76-33176# Transportation Systems Center, Cambridge, Mass.
DIGITAL TONE RANGING MODEM: DESIGN AND IMPLEMENTATION Final Report, Jul. 1971 - Jun. 1972
P. G. Mauro May 1976 64 p
(AD-A026888/7; ; DOT-TSC-FAA-75-24; FAA-RD-76-16) Avail: NTIS HC $4.50 CSCL 17/7
A digital ranging modem implementation based on side-tone ranging concepts is described. The ranging technique implemented and tested has direct application to the AEROSAT surveillance system. The performance of a breadboard unit was observed in the laboratory as well as under actual aeronautical and maritime experiments conducted with the NASA ATS-6 satellite. The technique demonstrated an acquisition probability of 0.98 for a signal-to-noise power density ratio, C/No, of 37 dB-Hz. The ranging precision of the modem is less than 66 meters. Circuit schematics, test data, test results, and analyses are included

along with recommendations for future applications of the demonstrated hardware. Author

N76-33177# National Aviation Facilities Experimental Center, Atlantic City, N.J.
AN INVESTIGATION INTO THE CAPABILITY OF MONITORING THE NADIF ANTENNA Final Report, Jun. - Jul. 1975
Nicholas J. Talotta and Donald E. Rogers Jun. 1976 41 p
(FAA Proj. 033-241-030)
(AD-A026889/6; FAA-NA-75-62; FAA-RD-76-96) Avail: NTIS HC $4.00 CSCL 17/7

A monitoring capability for air traffic control radar beacon system ground station equipment was developed. Tests were conducted on the dipole feed beacon antenna to determine if it could be monitored in the electrical near field of the antenna. Comparison type data were obtained in the electrical near and far field of the antenna. The data indicate that the antenna can be monitored in the near field on the standard antenna tower, providing the monitor pickup probe is carefully positioned. Author

N76-33178*# Systems Control, Inc., Palo Alto, Calif.
INFORMATION AND DISPLAY REQUIREMENTS FOR INDEPENDENT LANDING MONITORS Final Report, Jul. 1974 - Jul. 1975
J. S. Karmarker and J. A. Sorensen Washington NASA Aug. 1976 171 p refs
(Contract NAS1-13490)
(NASA-CR-2687) Avail: NTIS HC $6.75 CSCL 17G

The ways an Independent Landing Monitor (ILM) may be used to complement the automatic landing function were studied. In particular, a systematic procedure was devised to establish the information and display requirements of an ILM during the landing phase of the flight. Functionally, the ILM system is designed to aid the crew in assessing whether the total system (e.g., avionics, aircraft, ground navigation aids, external disturbances) performance is acceptable, and, in case of anomaly, to provide adequate information to the crew to select the least unsafe of the available alternatives. Economically, this concept raises the possibility of reducing the primary autoland system redundancy and associated equipment and maintenance costs. The required level of safety for the overall system would in these cases be maintained by upgrading the backup manual system capability via the ILM. A safety budget analysis was used to establish the reliability requirements for the ILM. These requirements were used as constraints in devising the fault detection scheme. Covariance propagation methods were used with a linearized system model to establish the time required to correct manually perturbed states due to the fault. Time-to-detect and time-to-correct requirements were combined to devise appropriate altitudes and strategies for fault recovery. Author

N76-33179*# Aerospace Systems, Inc., Burlington, Mass.
FORECAST OF THE GENERAL AVIATION AIR TRAFFIC CONTROL ENVIRONMENT FOR THE 1980'S Final Report, Nov. 1975 - Jun. 1976
William C. Hoffman and Walter M. Hollister Jun. 1976 133 p refs
(Contract NAS2-9067)
(NASA-CR-137909; ASI-TR-76-35) Avail: NTIS HC $6.00 CSCL 17G

The critical information required for the design of a reliable, low cost, advanced avionics system which would enhance the safety and utility of general aviation is stipulated. Sufficient data is accumulated upon which industry can base the design of a reasonably priced system having the capability required by general aviation in and beyond the 1980's. The key features of the Air Traffic Control (ATC) system are: a discrete address beacon system, a separation assurance system, area navigation, a microwave landing system, upgraded ATC automation, airport surface traffic control, a wake vortex avoidance system, flight service stations, and aeronautical satellites. The critical parameters that are necessary for component design are identified. The four primary functions of ATC (control, surveillance, navigation, and communication) and their impact on the onboard avionics system design are assessed. S.M.

N76-33180# Rockwell International Corp., Anaheim, Calif.
MICRO NAVIGATOR (MICRON) PHASE 2A. VOLUME 2: APPENDICES Final Report, 1 Apr. 1974 - 1 Aug. 1975
Joseph M. Miller Wright-Patterson AFB, Ohio AFAL Feb. 1976 232 p 2 Vol.
(Contract F33615-74-C-1099; AF Proj. 666A)
(AD-A021527; C74-455/201-Vol-2-App; AFAL-TR-75-210-Vol-2-App) Avail: NTIS CSCL 17/7

The objectives of the MICRON Phase 2A contract were to test N57A-1 and N57A-2; to design, fabricate and integrate two gyro subassemblies and one gyro test station; to test gyro and gyro subassemblies; and to perform analyses, studies and trade-offs for use in defining the MICRON system. Both N57A systems were flight tested, and the capability of the system to meet the position accuracy requirement was demonstrated. N57A-1 was used to demonstrate in-motion polhode damping. System reliability screen, Scorsby and heading sensitivity tests were successfully conducted on N57A-2. Two gyro subassemblies and one gyro test station were designed, fabricated, and integrated. One subassembly was used for MESGA development testing and one was used for 4-plate gyro and electronics development. Getter gyros were fabricated and tested. A gyro design evolved which meets the fast reaction requirement. A (small gap) gyro was developed which reduces the cost of gyro suspension electronics. System analyses, studies, and trade-offs were made which resulted in circuit simplification, reduced costs, and partitioning to meet maintainability and producibility requirements. GRA

N76-33181# RAND Corp., Santa Monica, Calif.
POLARIZATION USES IN LASERGYROS
H. B. Henning Oct. 1975 19 p refs Presented at the 1975 Annual Meeting of the Optical Soc. of Am., Boston, 21-24 Oct. 1975
(AD-A022212; P-5533) Avail: NTIS CSCL 17/7

Laser gyros are almost as well-known for their disabilities as for their performance capabilities. Of all their disabilities, however, the most prominent and perhaps the most fundamental defect of laser gyro operation is the lock-in phenomenon. This paper shows polarization can play a key role in circumventing the lock-in deficiencies of laser gyroscopes. Preliminary analysis in fact suggests that rotation rates down to 10 to the minus 8th power or 10 to the minus 9th power radians per second may be detectable by either system. This lends some hope to the possibility that accuracy goals may eventually be met. GRA

N76-33182# Missouri Univ., Rolla. Dept. of Electrical Engineering.
FORWARD-SENSED TERRAIN PROFILE COMPARISON FOR AIRCRAFT GEOGRAPHIC ORIENTATION Technical Report, 1 Mar. 1975 - 29 Feb. 1976
Gordon E. Carlson, George L. Bair, and Charles M. Benoit Mar. 1976 227 p
(Contract N00014-75-C-0639; NR Proj. 387-076)
(AD-A022904; CSR-76-3) Avail: NTIS CSCL 17/7

The feasibility of using forward-sensed horizon or fixed-range profiles as navigation checkpoints for aircraft or missile flights above the majority of the surrounding terrain is discussed. Digital topographic data and computer simulations used for system performance analyses and parameter tradeoffs are described. Analysis results are presented for different terrain roughnesses and with and without profile errors and vehicle altitude errors. System parameters and error limits are selected to give acceptable theoretical system performance. The results indicate that horizon profiles are unsuitable at higher altitudes since the long range to the profile produces excessive profile error sensitivity. The system using fixed-range profiles is shown to be theoretically feasible. The system parameters and error limits are also used to obtain required profile sensor characteristics. The effect of profile amplitude quantization is shown and minimum required computer wordlengths are established. Author (GRA)

N76-33183# Army Electronics Command, Fort Monmouth, N.J.
DOPPLER SENSOR SIMULATION MODEL Final Technical Report
Stanley Sokolowski and Matthew Fisher May 1976 50 p refs
(DA Proj. 1F2-62202-AH-85)

(AD-A024057; ECOM-4411) Avail: NTIS CSCL 17/7

Economic considerations require the investigation of alternatives to high precision navigation sensors. One alternative is a hybrid LORAN/DOPPLER system where components' accuracy specifications are somewhat relaxed. The hybrid system utilizes the long term position error stability of LORAN to restrain the divergent Doppler error. The synthesis of such a system depends on the establishment of a good computer simulation approach which, in turn, relies upon valid sensor models. Sensor model development begins with the constraints of Army mission requirements and a knowledge of the hardware, continues with the determination of an appropriate mathematical model, and concludes with a hardware verification phase. A DOPPLER model was developed to be used in the system computer simulation. Major factors involved in the development of the sensor model are discussed in this report. Author (GRA)

N76-33184# Mitre Corp., Bedford, Mass.
UNDERSTANDING INTERCEPT CONTROL
John J. Burke Mar. 1976 120 p refs
(Contract F19628-76-C-0001; AF Proj. 451A)
(AD-A023825; MTR-3133; ESD-TR-76-128) Avail: NTIS CSCL 17/7

Intercept control is the process of guiding an interceptor toward a target. This process requires the transmission of appropriate altitude, speed and heading commands to the interceptor in proper sequence. A procedure for determining interceptor commands in computer controlled systems was developed approximately two decades ago. This procedure with minor variations is currently being used in operational systems throughout the world. GRA

N76-33185# Naval Oceanographic Office, Washington, D.C.
OPTIMAL SMOOTHING: A POST SURVEY NAVIGATION DATA PROCESSING PROGRAM
Herman J. Byrnes and Samuel L. Fagin Oct. 1975 81 p refs
(AD-A023752; NOO-TR-242) Avail: NTIS CSCL 17/7

An optimal smoothing technique for processing survey navigation data is described, and a FORTRAN 4 computer program implementation is presented. The technique makes efficient use of navigation redundancy to produce an improved survey plot. The smoothing program, capable of operation in a variety of navigation modes, has been exercised using real and simulated survey data and is shown to have significant accuracy advantages. Author (GRA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N76-33186*# Lockheed-Georgia Co., Marietta.
TECHNICAL AND ECONOMIC ASSESSMENT OF SPAN-DISTRIBUTED LOADING CARGO AIRCRAFT CONCEPTS Final Report, 26 Mar. - 16 Aug. 1976
William M. Johnston, John C. Muehlbauer, Roy R. Eudaily, Ben T. Farmer, John F. Monrath, and Sterling G. Thompson Aug. 1976 127 p refs
(Contract NAS1-14383)
(NASA-CR-145034; LG76ER0013) Avail: NTIS HC $6.00 CSCL 01C

A 700,000 kg (1,540,000-lb) aircraft with a cruise Mach number of 0.75 was found to be optimum for the specified mission parameters of a 272 155-kg (600,000-lb) payload, a 5560-km (3000-n.mi.) range, and an annual productivity of 113 billion revenue-ton km (67 billion revenue-ton n. mi.). The optimum 1990 technology level spanloader aircraft exhibited the minimum 15-year life-cycle costs, direct operating costs, and fuel consumption of all candidate versions. Parametric variations of wing sweep angle, thickness ratio, rows of cargo, and cargo density were investigated. The optimum aircraft had two parallel rows of 2.44 x 2.44-m (8 x 8-ft) containerized cargo with a density of 160 kg/cu m (10 lb/ft 3) carried throughout the entire 101-m (331-ft) span of the constant chord, 22-percent thick, supercritical wing. Additional containers or outsized equipment were carried in the 24.4-m (80-ft) long fuselage compartment preceding the wing. Six 284,000-N (64,000-lb) thrust engines were mounted beneath the 0.7-rad (40-deg) swept wing. Flight control was provided by a 36.6-m (120-ft) span canard surface mounted atop the forward fuselage, by rudders on the wingtip verticals and by outboard wing flaperons. Author

N76-33187# National Aviation Facilities Experimental Center, Atlantic City, N.J.
ABBREVIATED FULL-SCALE FLIGHT TEST INVESTIGATION OF THE LOCKHEED L1011 TRAILING VORTEX SYSTEM USING TOWER FLY-BY TECHNIQUE Final Report, Jun. 1972
Leo J. Garodz May 1976 220 p refs
(AD-A028095/8; FAA-NA-75-14; FAA-AFS-1-76-2) Avail: NTIS HC $8.00 CSCL 01/3

A brief flight test program was conducted to investigate the time-history characteristics of the vortex system of a Lockheed L1011 airplane in terminal area-type operations using a 140-foot high instrumented tower. Vortex rotational flow velocities were measured by hot-film anemometers, vortex flow visualization--as outlined by tower-mounted smoke grenades--was documented and meteorological data were recorded. The test results showed that: (1) the L1011 vortex system was more persistent and intense than that of other heavy jet transport (300,000 lb) aircraft; (2) vortex dissipation was due primarily to vortex breakdown (bursting); (3) vortex core diameters were on the average about 5, 4, and 2 feet in diameter for the landing, approach, and takeoff configurations, respectively; (4) peak recorded tangential velocities were 126, 135, and 224 feet per second for these same respective configurations; (5) vortex lateral movement in-ground effect was approximately (pi/6.6)b, above ground level; and (6) average vortex descent velocities approached 6 feet per second out of ground effect. Author

N76-33188# Committee on Appropriations (U. S. Senate).
F-18 NAVY AIR COMBAT FIGHTER
Washington GPO 1975 111 p Hearings on H.R. 9861 before a subcomm. of the Comm. on Appropriations, 94th Congr., 1st Sess., 21 Oct. 1975
(GPO-60-913) Avail: Comm. on Appropriations

The controversy surrounding the selection of the F-18 is discussed along with a cost estimate for the F-18, the lack of commonality with the Air Force F-16, and the capability of the F-18 vis-a-vis the F-14. J.M.S.

N76-33189*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SEAT CUSHION TO PROVIDE REALISTIC ACCELERATION CUES FOR AIRCRAFT SIMULATORS
Billy R. Ashworth Sep. 1976 22 p refs
(NASA-TM-X-73954) Avail: NTIS HC $3.50 CSCL 14B

A seat cushion to provide acceleration cues for aircraft simulator pilots was built, performance tested, and evaluated. The four cell seat, using a thin air cushion with highly responsive pressure control, attempts to reproduce the same events which occur in an aircraft seat under acceleration loading. The pressure controller provides seat cushion responses which are considered adequate for current high performance aircraft simulations. The initial tests of the seat cushions have resulted in excellent pilot opinion of the cushion's ability to provide realistic and useful cues to the simulator pilot. Author

N76-33190*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STUDY OF A VERY LOW COST AIR COMBAT MANEUVERING TRAINER AIRCRAFT
Gary C. Hill and Jeffrey V. Bowles Aug. 1976 29 p refs
(NASA-TM-X-73162; A-6724) Avail: NTIS HC $4.00 CSCL 01C

A very low cost aircraft for performing Air Combat Maneuvering (ACM) training was studied using the BD-5J sport plane as a point of departure. The installation of a larger engine and increased fuel capacity were required to meet the performance and mission objectives. Reduced wing area increased the simulation of the ACM engagement, and a comparison with current

tactical aircraft is presented. Other factors affecting the training transfer are considered analytically, but a flight evaluation is recommended to determine the concept utility. Author

N76-33191# Army Aeromedical Research Lab., Fort Rucker, Ala.
VISIBLE AND NEAR INFRARED SPECTRAL TRANSMISSION CHARACTERISTICS OF WINDSCREENS IN ARMY AIRCRAFT Final Report
Wun C. Chiou Feb. 1976 20 p refs
(AD-A022769; USAARL-76-14) Avail: NTIS CSCL 01/3

The increasing application of electro-optical devices such as night vision goggles as aids in night flight demands a prerequisite evaluation of the optical quality and the visual detection thresholds of those devices when they operate through the aircraft windscreen. This report presents an analysis of the spectral transmission characteristics from 360 to 1080 nm spectral range of sixteen Army aircraft windscreen samples. The samples were from six fixed wing and seven rotary wing aircraft windscreens. GRA

N76-33192# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
WIND TUNNEL TEST OF A TWIN-ENGINED CANARD CONFIGURATED MINI-REMOTELY PILOTED VEHICLE M.S. Thesis
Charles D. Catoe Sep. 1975 98 p refs
(AD-A023359; GAE/AE/75S-10) Avail: NTIS CSCL 01/3

Many military applications are being found for small remotely piloted vehicles (Mini-RPVs). Professor Harold C. Larsen of the Air Force Institute of Technology (AFIT) has designed one such RPV. Under his direction a team of AFIT graduate students have studied and developed his preliminary design. From this design an aircraft has been built and flown. Flights of the original aircraft pointed out the need for larger engines and increased elevator power. The aircraft was redesigned by decreasing wing camber, increasing elevator size, and replacing the original 1.2 BHP engines with 2 BHP engines. A 1/3 scale wind tunnel model was modified to incorporate these design changes. Tests were made in the AFIT five-foot wind tunnel to determine static stability and control characteristics of the modified aircraft. This study included testing of the yaw, pitch, and roll axis characteristics. Limitations of the three component balance in the wind tunnel necessitated testing in each of the individual axes separately. GRA

N76-33193# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MOIRE OPTICAL TEMPERATURE MEASUREMENTS IN THERMALLY IRRADIATED AIRCRAFT MATERIALS M.S. Thesis
Richard T. Bennett Dec. 1975 59 p refs
(AD-A023341; GAE/AE/75D-7) Avail: NTIS CSCL 01/3

The feasibility of using a moire optical system to measure temperature distribution in thermally irradiated aircraft windshield material is shown. The moire system is based on schlieren apparatus which is modified to obtain quantitative information by installing moire gratings in the light path. A sample of plexiglass material was irradiated by a bank of ten, 6,000 watt infrared lamps. Photographs documented the resulting deflections in the moire interference patterns. Surface temperatures were determined by using a previously developed moire method for air boundary layers. The technique is developed for determining sample internal temperatures from moire deflections, and two internal temperature distributions are presented. GRA

N76-33194# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
EXPERIMENTAL AND THEORETICAL CONTROL SURFACE CHARACTERISTICS ON LOW ASPECT RATIO DELTA WING VEHICLES AT SUBSONIC MACH NUMBERS Final Report, May 1973 - Feb. 1975
Peter R. Gord Dec. 1975 147 p refs
(AF Proj. 1366)
(AD-A023408; AFFDL-TR-75-90) Avail: NTIS CSCL 01/3

An experimental study was conducted to determine the characteristics of control surfaces on low aspect ratio delta wings at subsonic Mach numbers. Included were parametric studies on control surface span, chord, and position, all of which were shown to have a significant effect on control surface performance. Comparisons were made with several low speed theories, and it was demonstrated that the vortex lattice theoretical approach provided an effective means of calculating control surface characteristics on both the study models and on several realistic configurations, including the X-24B and two early advanced air defense interceptor concepts. GRA

N76-33195# Aeronautical Systems Div., Wright-Patterson AFB, Ohio. Fatigue and Fracture Branch.
DERIVATION AND ANALYSIS OF LOADING SPECTRA FOR USAF AIRCRAFT Final Report, Jun. 1973 - Mar. 1974
Michael A. Landy, Mitchell P. Kaplan, and Joseph A. Reiman Jan. 1976 93 p refs
(AD-A023528; ASD-TR-76-1) Avail: NTIS CSCL 01/3

The report details a methodology for deriving a random flight-by-flight spectrum for a close air support type aircraft. In developing this spectrum it was necessary to first determine the stresses and their occurrences by using an 'all points in the sky' type loads analysis. The developed random spectrum was compared with a low-high-low block type spectrum using crack growth analysis and was found to give more conservative results. The baseline spectrum was regenerated with different random sequences to determine the effect of stress and flight ordering. Another study was made to determine whether omitting the ground loads affected the life. Both of these studies indicated crack growth life was minimally affected. GRA

N76-33196# United Technologies Corp., Stratford, Conn. Sikorsky Aircraft Div.
EVALUATION OF THE TRAC VARIABLE DIAMETER ROTOR: PRELIMINARY DESIGN OF A FULL-SCALE ROTOR AND PARAMETRIC MISSION ANALYSIS COMPARISONS Final Report
Evan A. Fradenburgh, Lee N. Hager, and Neville F. K. Keffort Feb. 1976 291 p refs
(Contract DAAJ02-74-C-0048; DA Proj. 1F2-63211-D-157)
(AD-A023448; SER-50952; USAAMRDL-TR-75-54) Avail: NTIS CSCL 01/3

A two-phase analytical investigation was conducted to continue the development and evaluation of the variable-diameter telescoping rotor aircraft (TRAC) rotor system. The first phase was a preliminary design of a full-scale, flightworthy rotor system suitable for subsequent wind tunnel testing in the NASA-Ames 40- by 80-foot wind tunnel and for flight testing on an H-3 helicopter or the NASA/Army Rotor Systems Research Aircraft (RSRA). The second phase of the investigation was a comparative parametric analysis to evaluate TRAC rotor compound helicopter and stowed rotor aircraft concepts relative to conventional-rotor pure and compound helicopters. GRA

N76-33197# Southwest Research Inst., San Antonio, Tex.
ENERGY-ABSORBING MATERIALS FOR IMPROVING HELICOPTER CRASHWORTHINESS Final Report
C. E. Kimball and R. C. DeHart Mar. 1976 25 p ref
(Contract N00014-70-C-0265; SwRI Proj. 03-2801)
(AD-A023006) Avail: NTIS CSCL 01/3

The purpose of the program was to identify materials which were not only suitable for structural components but were capable of absorbing energy at acceptable deceleration levels in a crash environment. After review of available materials for their energy absorption capability, five candidate materials were selected and a test program initiated to demonstrate their attenuation properties. Those selected were three types of honeycomb, a rigid foam, and a flexible foam. GRA

N76-33198# Honeywell, Inc., Minneapolis, Minn. Government and Aeronautical Products Div.
DEVELOPMENT AND FLIGHT TEST OF AN ADVANCED HYDROFLUIDIC STABILIZATION SYSTEM Final Report, 23 Nov. 1971 - 10 Jun. 1975
Darroll Bengtson, James Hedeen, and Robert Helfinstine Feb. 1976 230 p ref
(Contract DAAJ02-72-C-0019; DA Proj. 1F1-63204-D-157)
(AD-A023466; USAAMRDL-TR-76-2) Avail: NTIS CSCL 01/3

The objective of this program is to demonstrate the

performance of an advanced hydrofluidic stabilization system that is designed to provide pilot relief modes within a highly reliable, low-cost system. The system was designed, built, and tested to obtain the desired performance, and then subjected to flightworthiness testing to ensure structural integrity. The system was then installed, flight tested, and evaluated in a UH-1M helicopter. The flight test results are discussed. GRA

N76-33199# General Dynamics/Fort Worth, Tex.
INTEGRATION OF HYBRID STRUCTURE INTO LOW-COST AIRCRAFT DESIGN: RATIONALE AND METHODOLOGY Final Report, 1 Dec. 1974 - 30 Jun. 1975
T. E. Brents and J. H. Bridges Wright-Patterson AFB, Ohio AFFDL Dec. 1975 350 p refs
(Contract F33615-75-C-3029; AF Proj. 1207)
(AD-A023416; AFFDL-TR-75-124) Avail: NTIS CSCL 01/3

This report contains the rationale and methodology for using a blend of advanced metallics and advanced composites in the design of low-cost, low-weight aircraft. A systems engineering approach is developed via an example using a previously designed fighter aircraft as a baseline. The criteria for improvement is low life-cycle-costs for derivatives of the baseline aircraft that meet the specific performance measures. The rationale and methodology displayed pertains to the use of structural materials and associated manufacturing processes for airframe construction. The emphasis is on cost related decisions made during the conceptual design phase. This report contains a description of the salient properties of materials, typical material applications, and a description of the manufacturing processes associated with the materials. The rationale and methodologies described can be used for conceptual design of all types of aircraft. The specific results obtained are indicative of the value of advanced metallics and advanced composites. From a cost viewpoint, it is concluded that research and development of both advanced metallics and advanced composites should be continued. Author (GRA)

N76-33200# Textron, Inc., Buffalo, N.Y. Bell Aerospace Div.
TESTS OF THE BELL AEROSPACE LA-4 ACLS FITTED WITH SUCTION BRAKING AND PREDICTIONS FOR OTHER AIRCRAFT Final Report, Jan. - May 1975
T. D. Earl, C. L. Stauffer, and C. E. Satterlee Nov. 1975 54 p refs
(Contract F33615-75-C-3038)
(AD-A023850; AFFDL-TR-75-135) Avail: NTIS CSCL 01/2

A test program was conducted by Textron's Bell Aerospace Company, using their air cushion landing system (ACLS) equipped Lake LA-4 aircraft to investigate the potential of a suction braking ACLS subsystem. The new braking subsystem was tried on dry and wet runway and rough grass. Deceleration up to 0.5g was recorded with the suction flow available. The potential of a developed system applied to a cushion planform designed to utilize suction braking exceeds this range, and the report predicts effective potential application to the C-130, Jindivik, and XC-8A. GRA

N76-33201# Boeing Vertol Co., Philadelphia, Pa.
ADVANCED HELICOPTER STRUCTURAL DESIGN INVESTIGATION. VOLUME 2: DESIGN APPLICATION STUDY FOR FREE PLANET TRANSMISSIONS Final Report, Jun. 1974 - May 1975
John C. Mack and William Rumberger Mar. 1976 81 p refs
(Contract DAAJ02-74-C-0066; DA Proj. 1F2-62208-AH-90)
(AD-A024478; D210-10965-2; USAAMDRL-TR-75-56B-Vol-2) Avail: NTIS CSCL 01/3

The free planet gear drive was applied to the requirements of the Medium-Range Utility Transport Helicopter. Design studies showed potential advantages for the free planet drive as compared to conventional planetary systems used hitherto. Recommendations were made that existing free planet hardware be further tested to better define load-carrying capability and system reliability. Author (GRA)

N76-33202# General Dynamics/Convair, San Diego, Calif.
DEVELOPMENT OF PREDICTION TECHNIQUES FOR AERODYNAMIC LOADS ACTING ON EXTERNAL STORES Final Report
Maurice B. Sullivan Nov. 1975 333 p refs
(Contract F33615-73-C-3011; AF Proj. 1367)
(AD-A021435; AFFDL-TR-73-126) Avail: NTIS CSCL 01/1

A preliminary design technique for the prediction of aerodynamic loads acting on external stores has been established through an empirical correlation of wind tunnel results obtained on a scale model of the F-111. Approximately 30,000 engineering data points were surveyed for various combinations of external stores. These data, originally stored on magnetic tape, were transferred to CDC 6600 disk packs. This was done to reduce the amount of computer run time required to collect the desired samples of data. For this study, correlations were performed of each aerodynamic component of load or moment acting on a particular store grouping as a function of various geometry parameters. The work was accomplished primarily through the utilization of numerical programs in which, through a series of trial and error calculations, an equation composed of various key geometry parameters was generated. The equations obtained for the numerical programs predict normal force, side force, pitching moment, yawing moment, and rolling moment for various external store arrangements. GRA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N76-33203# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Instrumentierung und Anthropotechnik.
FLIGHT SIMULATOR EVALUATION OF AN ELECTRONIC PARAVISUAL GUIDANCE INDICATOR
Josef Thomas and Ernst Kohnen 6 May 1976 46 p refs In GERMAN; ENGLISH summary Report will also be announced as translation
(DLR-FB-76-28) Avail: NTIS HC $4.00; DFVLR, Cologne DM 21.30

An electronic paravisual indicator presenting a checkerboard pattern moving in two axes in a head-down display was evaluated in a moving cockpit flight simulator. The effect was directed towards the effects of the indicator on piloting accuracy and pilot workload in manually controlled ILS- and flight director approaches. In the overall assessment, based on objective performance criteria and subjective pilot ratings, the statistical evaluation of the objective test data showed no significant influence of the indicator on the performance criteria, whereas the pilot ratings suggest that the indicator may be useful for manual control of the lateral motion of an aircraft. Author (ESA)

N76-33204# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.
HEAD-UP DISPLAY SYMBOLOGY Phase Report, 13 May - 12 Jun. 1975
William P. Orrick, Jr. and Phyllis E. York 31 Dec. 1975 79 p refs
(AD-A022655; NADC-75267-40) Avail: NTIS CSCL 01/3

This report consists of a table and accompanying illustrations which describe aircraft and weapons system functions displayed on the head-up displays in the A-7E, F-5, F-14, F-15, F-111A, CL-84, and AV-8A aircraft. Corresponding display formats as given in MIL-D-81641(AS) and MIL-STD-884B are included for comparison. GRA

N76-33205# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
THE OPTICAL CONVOLUTION AIRSPEED INDICATOR Final Report, 18 Feb. - 18 Aug. 1975
Michael J. Rudd Nov. 1975 67 p refs
(Contract F33615-75-C-3085; AF Proj. 1987)
(AD-A023206; BBN-3009R; AFFDL-TR-75-125) Avail: NTIS CSCL 01/4

The Optical convolution Velocimeter is a simple, inexpensive instrument for the measurement of airspeed. A shadowgraph of a hot turbulent wake is projected onto a grating, and the reflected light fluctuates at a frequency proportional to the velocity of

convection. The theory of the instrument is presented, and its feasibility for airspeed measurement is discussed. The instrument has been tested in a low speed wind tunnel, on a light aircraft and compared with a Laser Velocimeter. Author (GRA)

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N76-33206*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECTS OF LONG-CHORD ACOUSTICALLY TREATED STATOR VANES ON FAN NOISE. 2: EFFECT OF ACOUSTICAL TREATMENT

James H. Dittmar, James N. Scott, Bruce R. Leonard, and Edward G. Stakolich Washington Oct. 1976 99 p refs

(NASA-TN-D-8250; E-8736) Avail: NTIS HC $5.00 CSCL 21E

A set of long chord stator vanes was designed to replace the vanes in an existing fan stage. The long chord stator vanes consisted of a turning section and axial extension pieces, all of which incorporated acoustic damping material. The long chord stator vanes were tested in two lengths, with the long version giving more noise reduction than the short, primarily because of the additional lining material. The noise reduction achieved with the acoustically treated long chord stator vanes was compared with the reduction achieved by an acoustically treated exhaust splitter. The long chord stator was at least as good as the splitter as a method for incorporating acoustic lining material. In addition, comparing an acoustic three ring inlet and an acoustic wall-only inlet discloses that the wall-only inlet could be used in an engine where the noise reduction requirements are not too stringent. Author

N76-33207*# Scientific Translation Service, Santa Barbara, Calif.

CHOICE OF COMPRESSOR PRESSURE RATIO OF SMALL GAS TURBINES PLACED IN A BYPASS ENGINE DUCT

B. D. Fishbeyn Washington NASA Oct. 1976 13 p refs Transl. into ENGLISH from Izvestiya vysshikh uchebnykh zavedeniy, aviatsionnaya tekhnika (USSR), no. 1, Jan. 1966 p 78-85

(Contract NASw-2791)

(NASA-TT-F-17280) Avail: NTIS HC $3.50 CSCL 21E

The bypass engine scheme with small gas turbine was studied. It is found that a two duct engine with small gas turbine in the outer duct increases the thrust of ordinary bypass engines up to Mach numbers of 2.8. Author

N76-33208*# General Applied Science Labs., Inc., Westbury, N.Y.

EFFECT OF INLET TEMPERATURE AND PRESSURE ON EMISSIONS FROM A PREMIXING GAS TURBINE PRIMARY ZONE COMBUSTOR Final Report

Gerald Roffe Washington NASA Sep. 1976 48 p refs

(Contract NAS3-18563)

(NASA-CR-2740; GASL-TR-227) Avail: NTIS HC $4.00 CSCL 21E

Experiments were conducted to determine the performance of a premixing prevaporizing gas turbine primary zone combustor design over a range of combustor inlet temperatures from 700 to 1000 K and a range of inlet pressures from 40 to 240 N/sq cm. The 1 meter long combustor could be operated at pressures up to and including 120 N/sq cm without autoignition in the premixing duct or flashback from the stabilized combustion zone. Autoignition occurred in the mixer tube at the 240 N/sq cm pressure level with an entrance temperature of 830 K and a mixer residence time of 4 msec. Measured NOx level, combustion inefficiency, and hydrocarbon emission index correlated well with adiabatic flame temperature. The NOx levels varied from approximately 0.2 to 2.0 g NO_2/kg fuel at combustion inefficiencies from 4 to 0.04 percent, depending upon adiabatic flame temperature and pressure. Measured NOx levels were sensitive to pressure. Tests were made at equivalence ratios ranging from 0.35 to 0.65. The overall total pressure drop for the configuration varied slightly with reference velocity and equivalence ratio, but never exceeded 3 percent. Author

N76-33209# AiResearch Mfg. Co., Phoenix, Ariz.

DETERMINATION OF EFFECTS OF AMBIENT CONDITIONS ON AIRCRAFT ENGINE EMISSIONS ENGINE TESTING. VOLUME 1: GTCP 85 APU, TPE 331 TURBOPROP Final Report, 20 Dec. 1974 - 20 Dec. 1975

Gerrick A. Slogar Mar. 1976 182 p 2 Vol.

(Contract EPA-68-03-2156)

(PB-252825/5; Rept-75-311636-1; EPA-460/3-76-009-a-Vol-1) Avail: NTIS HC $7.50 CSCL 13B

Full scale engine tests were conducted on a GTCP85-98CK auxiliary power unit and a TPE331-251M turboprop engine. Exhaust emission of HC, CO, CO_2, NOx, and smoke was measured at controlled (temperature, humidity, and pressure) engine inlet conditions. The data provide a data base for the determination of the effects of ambient conditions on gas turbine engines. GRA

N76-33210# AiResearch Mfg. Co., Phoenix, Ariz.

DETERMINATION OF EFFECTS OF AMBIENT CONDITIONS ON AIRCRAFT ENGINE EMISSIONS ENGINE TESTING. VOLUME 2: GTCP 85 APU, TPE 331 TURBOPROP Final Report, 20 Dec. 1974 - 20 Dec. 1975

Gerrick A. Slogar and R. C. Holder Mar. 1976 301 p refs 2 Vol.

(Contract EPA-68-03-2156)

(PB-252826/3; Rept-75-311636-2; EPA-460/3-76-009-b-Vol-2) Avail: NTIS HC $9.75 CSCL 13B

For abstract, see N76-33210.

N76-33211# Westinghouse Electric Corp., Lima, Ohio.

AC POWER CONTROLLERS FOR B-1 FLIGHT TESTS. PART 1: DESIGN, DEVELOPMENT, FABRICATION AND TESTING OF HYBRID POWER CONTROLLERS Final Report, Jan. 1974 - Sep. 1975

W. W. Billings Sep. 1975 148 p refs

(Contract F33615-73-C-2082; AF Proj. 3145)

(AD-A022616; AFAPL-TR-75-68-Pt-1) Avail: NTIS CSCL 01/3

Fifty-nine solid state power controllers have been developed, fabricated and tested. These hybrid devices are rated at 1.5 A/230 V/400 Hz, provide the control-protect-indicate functions, are hermetically sealed, and are packaged in a flight worthy configuration. Significant tests performed are: EMI, temperature-altitude, random vibration, and load-life. Details on the design, assembly, testing and reliability analysis are included in this report. In a separate volume is the Radiation Hardening Report, Classified, Part II. Author (GRA)

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N76-33212*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

FLIGHT DATA IDENTIFICATION OF SIX DEGREE-OF-FREEDOM STABILITY AND CONTROL DERIVATIVES OF A LARGE CRANE TYPE HELICOPTER

Robert L. Tomaine (USAAMRDL, Hampton, Va.) Sep. 1976 55 p refs

(NASA-TM-X-73958) Avail: NTIS HC $4.50 CSCL 01C

Flight test data from a large 'crane' type helicopter were collected and processed for the purpose of identifying vehicle rigid body stability and control derivatives. The process consisted

of using digital and Kalman filtering techniques for state estimation and Extended Kalman filtering for parameter identification, utilizing a least squares algorithm for initial derivative and variance estimates. Data were processed for indicated airspeeds from 0 m/sec to 152 m/sec. Pulse, doublet and step control inputs were investigated. Digital filter frequency did not have a major effect on the identification process, while the initial derivative estimates and the estimated variances had an appreciable effect on many derivative estimates. The major derivatives identified agreed fairly well with analytical predictions and engineering experience. Doublet control inputs provided better results than pulse or step inputs. Author

N76-33213*# Kanner (Leo) Associates, Redwood City, Calif.
REALIZATION OF FAILURE DETECTION IN DIGITAL FLIGHT CONTROL SYSTEMS
K. D. Holle Washington NASA Oct. 1976 14 p Transl. into ENGLISH of "Realisierung der Ausfallerkennuns in Digitalen Flugregler", Deut. Forsch.- und Versuchsanstalt fuer Luft- und Ramfahrt E. V., Ueberlingen, 1974 p 1-12
(Contract NASw-2790)
(NASA-TT-F-17277) Avail: NTIS HC $3.50 CSCL 01C

An outline is given of the methods used for failure detection in the Honeywell 316, which is used for flight control in the HFV 320 Hansa-Jet. The circuitry which monitors the redundant subsystems is illustrated, and the way it reacts to malfunctions is described. Methods are shown for monitoring such devices as adders, DACs, and ADCs and for monitoring memory. Author

N76-33214# Army Materiel Systems Analysis Agency, Aberdeen Proving Ground, Md.
EFFECT OF GUN PULSE ON HELICOPTER ATTITUDES
R. R. Oehrli Feb. 1976 39 p ref
(DA Proj. 1R7-65706-M-541)
(AD-A023461; AMSAA-TR-154) Avail: NTIS CSCL 01/2

Computer programs have been devised to calculate both steady state pitch attitude and dynamic pitch response to a pulse, gun-initiated moment of a typical helicopter. It is shown that for large fixed gun pulses the resulting motions may be difficult to control. A critical condition is the ability to hold position and attitude at hover. GRA

N76-33215# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE INFLUENCE OF ROLL, PITCH, AND YAW RATE PERTURBATIONS ON THE ALPHA-BETA STABILITY ENVELOPE OF THE F-4D AIRCRAFT M.S. Thesis
Douglas R. Withers, Jr. Jan. 1976 108 p refs
(AD-A023216) Avail: NTIS CSCL 01/1

A study was made of the influence of pitch, roll, and yaw rate perturbations on an alpha-beta stability envelope of the F-4D aircraft. The nonlinear equations of motion were integrated numerically and the motion analyzed for stability. The stability criteria were adapted from MIL-F-8785B(ASG), 'Military Specification - Flying Qualities of piloted Airplanes'. Equilibrium conditions were perturbed and the stability analyses revealed two characteristic motions. The stable motion was a yaw divergence with a minor roll oscillation. Whereas the unstable motion was a divergence in roll. The aircraft appears to enter a steep, rolling dive. GRA

N76-33216# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A SIMULATION EXPERIMENT TO VERIFY DIFFERENTIAL THRUST CONTROLLER DESIGNS FOR AN AIR CUSHION VEHICLE M.S. Thesis
Adrian C. Troy Mar. 1976 122 p refs
(AD-A024606; GE/EE/76-5) Avail: NTIS CSCL 01/2

A manned simulation of an air cushion landing system vehicle was conducted to test the validity of differential thrust controllers that varied with the vehicle's engine time delay. The task was maintaining a constant heading angle in the presence of random wind disturbances. The mean square and root mean square data were obtained from the simulation and statistically analyzed to predict the controller performance. A detailed discussion of human factors in experiment design, and proper statistical techniques for handling resultant data are included. GRA

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N76-33217# Division of Mechanical Engineering, Ottawa (Ontario). Engine Lab.
MODEL STUDY OF A PROPOSED ENGINEERING ACOUSTIC RESEARCH FACILITY
G. W. Johnston (Toronto Univ., Ontario), F. Rueter, and M. S. Chappell Jul. 1976 33 p refs
(ME-243; NRC-15480; ISSN-0077-555X) Avail: NTIS HC $4.00

A one-twelfth scale aeroacoustic model of a proposed engineering acoustic research facility has been tested to assess the background noise levels in the anechoic measurement area, and to develop a suitable exhaust collector for deflected jet conditions. The facility comprises an open circuit, open jet wind tunnel with an anechoic space surrounding the test section. Collector configurations with acceptably low background noise and low sensitivity to jet deflection have been defined, but these features were achieved at the expense of some aerodynamic efficiency. Author

N76-33218# National Aviation Facilities Experimental Center, Atlantic City, N.J.
EFFECTIVENESS OF A PILOT GROUND TRAINER AS A PART TASK INSTRUMENT FLIGHT RULES FLIGHT-CHECKING DEVICE STAGE 2 Final Report, Sep. 1974 - Sep. 1975
Robert J. Ontiveros Jun. 1976 66 p refs
(FAA Proj. 184-530-000)
(AD-A026754/2; FAA-NA-75-60; FAA-RD-76-72) Avail: NTIS HC $4.50 CSCL 05/9

The second stage of a two stage experiment was conducted to determine if a pilot ground trainer (PGT) could be used to flight check instrument pilot applicants on instrument approaches in lieu of performing these tasks in an aircraft on their initial instrument flight check. Based on the comparative PGT and aircraft performance scores of a control and experimental group, the results of Stage II indicate that an appropriately equipped PGT may be used to flight check instrument pilot applicants on the automatic direction finder very high frequency omni-directional radio range, and instrument landing system approaches. Equipment and capabilities required for the ground trainer to be effective as a part task flight checking device for accomplishing these tasks are listed. Significant differences between PGT and aircraft performance scores are discussed. Factors contributing to the performance differences are identified. Author

N76-33219# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
PAVEMENT RESPONSE TO AIRCRAFT DYNAMIC LOADS: VOLUME 3: COMPENDIUM Final Report
Richard H. Ledbetter Jun. 1976 95 p refs
(Contract DOT-FA71WAI-218)
(AD-A028378/8; FAA-RD-74-39-III; TR-S-75-11-Vol-3) Avail: NTIS HC $5.00 CSCL 01/5

Instrumented aircraft were used to apply static and dynamic loads to instrumented pavement structures. A compendium of the testing program, the instrumentation systems, the reduction and analysis of data, and the test results is presented. Measurements of displacement, velocity, pressure, and temperature were made in the two pavement structures. Two phases of material behavior, elastic and inelastic, in both flexible and rigid pavement structures were identified. The tests showed that no basic aircraft ground operating mode induced pavement responses greater than those occurring for static load conditions. However, extrapolations of the test results indicate that for stiff pavement structures unusual conditions of dynamic loading could cause responses larger than what would occur under static loading. This behavior is possible because of the inelastic behavior being

of low magnitude for stiff pavements. The test results also indicate that a reduction in the thickness of pavement structures could be allowed in the interior of runways except at exits where aircraft side thrust is high. Author

N76-33220# Federal Aviation Administration, Washington, D.C.
GROUND-BASED WARM FOG DISPERSAL SYSTEMS. TECHNIQUE SELECTION AND FEASIBILITY DETERMINATION WITH COST ESTIMATES Final Report, Aug. 1973 - Nov. 1975
Nov. 1975 77 p refs
(AD-A028093/3; FAA-RD-75-126) Avail: NTIS HC $5.00 CSCL 01/5

An engineering study is presented which determined the feasibility and conceptual design for a ground-based warm fog dispersal system at a selected airport which had a high frequency of fog and a large air traffic volume. Los Angeles International Airport (LAX) was selected as the airport for study. A brief review of warm fog dispersal mechanisms is considered. The results indicate that heat is presently the only reliable technique for warm fog dispersal. Two methods of applying heat to fog were studied in detail, namely, the Thermokinetic and Modified Passive Thermal. Engineering costs estimates were developed. The results of the study indicate that both systems would be cost effective at Los Angeles International Airport. For improving the visibility in fog to category 2 minimums, the 12-year benefit-to-cost ratio of the Thermokinetic Fog Dispersal System which uses natural gas for fuel is 8.7 to 1 while the Modified Passive Thermal Fog Dispersal System has a ratio of 4.8 to 1. It was concluded that a Thermal Fog Dispersal System at LAX is both feasible and cost effective. Author

N76-33221*# Kanner (Leo) Associates, Redwood City, Calif.
TWO-DIMENSIONAL AIRFOIL TEST FACILITY IN THE MODANE-AVRIEUX S3 BLOWDOWN WIND TUNNEL
M. Bazin Washington NASA Oct. 1976 25 p refs Transl. into ENGLISH of ONERA Report NT-203, Office Natl. d'Etudes et de Recherches Aerospatiales, Paris, Oct. 1972 p 1-15
(Contract NASw-2790)
(NASA-TT-F-17253) Avail: NTIS HC $3.50 CSCL 14B

A device for two dimensional airfoil profile testing in the transonic test section of the S3 blowdown wind tunnel was designed and built. Airfoils up to 0.3 m chord length were studied by pressure measurements up to 0.95 Mach, with stagnation pressure from 1.2 to 4.0 bar. The Reynolds number can be varied up to 15,000,000 at Mach 0.95. The main features of the device are outlined and its various components described, including a 0.78 x 0.56 m test section with horizontal perforated walls, rotating supports for angle of attack variations from -35 to +215 deg, mobile rake for wake pressure survey, and models with wall pressure taps. The method and means for data acquisition are given, along with the aerodynamic characteristics of the test device. The visualization methods are described, and improvements are suggested. Author

N76-33222*# Kanner (Leo) Associates, Redwood City, Calif.
SELF-CORRECTING WALLS FOR A TRANSONIC WIND TUNNEL
J.-P. Chevallier Washington NASA Oct. 1976 28 p refs Transl. into ENGLISH of a paper presented at the 12eme Colloque d'Aerodynamique Appliquee, ENSMA/CEAT, Poitiers, France, 5-7 Nov. 1975
(Contract NASw-2790)
(NASA-TT-F-17254) Avail: NTIS HC $4.00 CSCL 14B

A concept proposed to remedy the difficulties of application of wall correction effects in high transonic flow with nonlinear phenomena is described. The concept consists of active control of the perturbation component normal to the wall, based on iterative calculation of the virtual flow in an unbounded region outside the tunnel section. The principles and means of application of the test procedure, the preliminary study of a pilot facility, and the results obtained in two dimensional flow are described. Conclusions are given. Author

N76-33223*# Scientific Translation Service, Santa Barbara, Calif.
INFLUENCE OF WIND TUNNEL WALL BOUNDARY LAYERS ON TWO-DIMENSIONAL TRANSONIC TESTS
R. Bernard-Guelle Washington NASA Oct. 1976 32 p refs Transl. into ENGLISH from the French report Presented at the 12th Appl. Aerodyn. Colloq., ENSMA/CEAT, Poitiers, France, 5-7 Nov. 1975
(Contract NASw-2791)
(NASA-TT-F-17255) Avail: NTIS HC $4.00 CSCL 14B

The two-dimensional test section of the ONERA RICh wind tunnel is equipped with a porous wall permitting partial aspiration of the boundary layer upstream of the model. The aspiration rate is adjustable and generates a variation of the displacement thickness; this varies from 5 to 1% of the model half-span, permitting in some cases the extrapolation of the results to a limit case of no boundary layer. Some results are presented that were obtained on two references profiles: NACA 0012 and LC 100 D, in the subsonic and transonic domain. Author

N76-33224# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
AIRPORT TOTAL SYSTEM Final Report
J. Boothby, P. D. McGinity, and N. J. Ashford Aug. 1975 75 p refs Sponsored by Sci. Res. Council
(TT-7513) Avail: NTIS HC $4.50

Six main areas were considered in the study of airports: the general requirements for a simplified model of activity, the nature of air travel demand, elements for airport function, airline provision policy, pricing of airport facilities, and facility investment. Their place in the model was given specific attention. Emphasis was placed upon two main areas: the relevance of a purely output-based airport typology and the relationships between output, typology, predictability, and investment. Author (ESA)

N76-33225# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ENGINEERING STUDY OF THE UPT SIMULATOR FACILITY. VOLUME 1: EXECUTIVE SUMMARY DESIGN STUDY M.S. Thesis
Peter C. Christoplis, William P. Cobb, Anthony Eden, Ronald E. Matestic, and Arthur W. Meyer Dec. 1975 34 p
(AD-A021272; GCE/MC/75-1) Avail: NTIS CSCL 14/2

The engineering design of the Undergraduate Pilot Training Simulator Facility was examined. Application of a truss and column system for maximum flexibility, economical exterior wall sections, and selective electrical distribution systems for increased reliability were studied along with high pressure sodium lamps for outdoor and high bay lighting, a solar energy powered domestic water system, and cooling load reduction of light bank and terrain board system. The computer program ECUBE is demonstrated as a tool of analysis. GRA

N76-33226# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ENGINEERING STUDY OF THE UPT SIMULATOR FACILITY. VOLUME 2: MAIN REPORT TEXT AND APPENDICES, DESIGN STUDY M.S. Thesis
Peter C. Christoplis, William P. Cobb, Anthony Eden, Ronald E. Matestic, and Arthur W. Meyer Dec. 1975 462 p refs
(AD-A021273; GCE/MC/75-2) Avail: NTIS CSCL 14/2

An interdisciplinary engineering design study is reported on the Undergraduate Pilot Training Simulator Facility. The goal of the study was to explore alternative designs and methods to save money and energy while enhancing flexibility, reliability, and maintainability. The following systems were selected to attain these goals: (1) an alternate functional plan that provides for the application of a truss and column system for maximum flexibility, (2) a more economical exterior wall section, (3) a primary selective-secondary selective electrical distribution system for increased reliability, (4) high pressure sodium lamps for outdoor and high bay lighting, (5) a solar energy powered domestic water system, and (6) cooling load reduction of light bank and terrain board system. The use of the computer program ECUBE is demonstrated as a tool of analysis in determining heating and cooling loads for design and selection of the mechanical system. GRA

N76-33227# Army Construction Engineering Research Lab., Champaign, Ill.
LIFE2 USER'S MANUAL Final Report
E. S. Lindow, E. L. Marvin, P. F. McManus, J. J. Brown, and F. Kuo Jan. 1976 119 p refs

(DA Proj. 4A7-63734-DT-08)
(AD-A023186; CERL-TR-C-59) Avail: NTIS CSCL 13/2

This report describes a digital computer program that enables pavement designers and planners to analyze the consequences of available pavement design alternatives. The program includes analytical procedures for designing rigid and flexible pavements for airfields, roads, and streets. In addition, this program is capable of evaluating maintenance and repair strategies. The resulting combinations of design schemes and maintenance strategies are ranked by total cost over the design life of the pavement. The manual presents background information about the program's analytical methodology and provides detailed instructions for its operation and input preparation. Author (GRA)

N76-33228# Stanford Research Inst., Menlo Park, Calif.
ENVIRONMENTALLY COMPATIBLE AIRCRAFT CRASH AND RESCUE TRAINING FACILITIES Final Report, 1976
R. S. Alger, S. B. Martin, and A. E. Lipska 24 Oct. 1975 59 p refs
(Contract N60921-75-C-0184)
(AD-A024503; NSWC/WOL/TR-75-205) Avail: NTIS CSCL 01/2

With the increasing sophistication of aircraft has come a corresponding increase in payload of weapons, fuel and cargo which is reflected in a potential increase in accidents and fires. This report is concerned with development of training facilities and techniques to enhance the capability of firemen in coping with their fires, while still maintaining a reasonable level of environmental impact. Training objectives are reviewed and evaluation criteria are discussed. Location and operation of training facilities are analyzed from a cost - effectiveness viewpoint. Three levels of training are described. It is concluded that the essential facilities can be realized within the environmental constraints, but additional cost-benefit analysis is recommended. Author (GRA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N76-33229*# Joint Publications Research Service, Arlington, Va.
SPACECRAFT LAUNCHINGS IN THE USSR (MARCH - APRIL 1976)
Washington NASA Oct. 1976 4 p Transl. into ENGLISH from Priroda (USSR), no. 8, Aug. 1976 p 129
(NASA-TT-F-17238) Avail: NTIS HC $3.50 CSCL 22A

A brief summary of Soviet space activities during March and April, 1976 is presented. Author

N76-33230*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APOLLO EXPERIMENT S-217 IR/RADAR STUDY OF APOLLO DATA Final Report
Thomas W. Thompson, Henry J. Moore (USGS), Gerald G. Schaber (USGS), Richard W. Shorthill (Utah Univ. Res. Inst.), Ewen A. Whitaker (Arizona Univ.), and Stanley H. Zisk 1 Oct. 1976 20 p refs
(Contract NAS7-100; Grant NsG-7014)
(NASA-CR-148841; JPL-TM-33-787) Avail: NTIS HC $3.50 CSCL 22A

An experiment using Earth based remote sensing radar, infrared eclipse, and color difference data to deduce surface properties not visible in Apollo photography is reported. The Earth based data provided information on the small scale (centimeter sized) blockiness and on the surface chemical composition (titanium and iron contents) of the lunar surface. These deduced surface properties complemented the new Apollo photography, leading to refined geologic interpretations of the lunar surface. Author

N76-33231*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: COMMAND AND SERVICE MODULE CONTROLS AND DISPLAYS SUBSYSTEM
Aaron B. Olsen and Robert J. Swint Sep. 1976 29 p
(NASA-TN-D-8301; JSC-S-463) Avail: NTIS HC $4.00 CSCL 22B

A review of the command and service module controls and displays subsystem is presented. The subsystem is described, and operational requirements, component history, problems and solutions, and conclusions and recommendations for the subsystem are included. Author

N76-33232# Erlangen-Nuremberg Univ. (West Germany). Inst. fuer Werkstoffwissenschaften VI.
PLANNING STUDY FOR PREPARATION OF SINGLE CRYSTAL EXPERIMENTS
Herbert Weiss Bonn Bundesmin. fuer Forsch. u. Technol. Mar. 1976 33 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-1074; GfW-RV-21-V-67/74)
(BMFT-FB-W-76-02) Avail: NTIS HC $4.00; ZLDI, Munich DM 6.50

In order to conceive suitable space experiments with single crystals their properties desired for technical applications must first be considered. By comparing the production possibilities, including their limitations in space and on earth, it is possible to design space experiments, with the selection concerning both material and method of growth. There are technically important single crystals such as silicon for integrated circuits or III-V-compounds for optoelectronic devices as well as model substances like InSb or InSb/NiSb which are favorably suited for studying the special problems of crystal growing in space. Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N76-33233*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
DISPERSION ANALYSIS FOR BASELINE REFERENCE MISSION 3A USING POWERED EXPLICIT GUIDANCE
L. S. Snow 9 Dec. 1975 47 p refs
(Contract NAS9-13970)
(NASA-CR-150967; DN-1.4-7-21) Avail: NTIS HC $4.00 CSCL 22A

A dispersion analysis considering 3 sigma uncertainties (or perturbations) in platform, vehicle, and environmental parameters was performed for baseline reference mission 3A. Powered explicit guidance (PEG) was used to develop closed loop steering commands for this dispersion analysis. The nominal profile for the dispersion analysis is identical to the nominal profile of Reference 1 ascent trajectory with the exception that generalized linear tangent (GLT) guidance is used in Reference 1. Nominal trajectory differences which result from using PEG instead of GLT were determined and dispersion data were developed using PEG for comparison with similar data developed using GLT guidance. Author

N76-33234*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
ORBITER ENTRY TRAJECTORY CORRIDORS: 32000 POUND PAYLOAD, 67.5 PERCENT CENTER OF GRAVITY
J. H. Treybig 9 Jul. 1975 150 p refs
(Contract NAS9-13970)
(NASA-CR-151008; DN-1.4-8-4) Avail: NTIS HC $6.00 CSCL 22A

Thermal and equilibrium glide boundaries were used to analyze and/or design shuttle orbiter entry trajectories. Plots are presented of orbiter thermal and equilibrium glide boundaries in the drag/mass-relative velocity dynamic pressure-relative velocity, and altitude-relative velocity planes for an orbiter having a 32,000 pound payload and a 67.5% center of gravity location. These boundaries were defined for control points 1 through 4 of the shuttle orbiter for 40 deg-30 deg and 38 deg-28 deg ramped angle of attack entry profiles and 40 deg, 38 deg, 35 deg, 30 deg, 28 deg, and 25 deg constant angle of attack entry profiles each at 20 deg, 15 deg, and 10 deg constant body flap settings. Author

N76-33235*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
RETURN-TO-LAUNCH-SITE TRAJECTORY SHAPING
R. L. Bown 17 Oct. 1975 22 p refs
(Contract NAS9-13970)
(NASA-CR-151009; DN-1.4-4-14) Avail: NTIS HC $3.50 CSCL 22A

The results are presented of a study to show the effect on flyback trajectories of constant inertial attitude during the fuel dissipation phase of a return-to-launch-site abort. It is shown that the value of the constant inertial attitude can be chosen to shape the flyback trajectory. Author

N76-33236*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
RETURN-TO-LAUNCH-SITE THREE DEGREE OF FREEDOM ANALYSIS, CONSTANT INERTIAL ATTITUDE DURING THE FUEL DISSIPATION PHASE
R. L. Bown and L. C. Winans 17 Oct. 1975 19 p refs
(Contract NAS9-13970)
(NASA-CR-151010; DN-1.4-4-7) Avail: NTIS HC $3.50 CSCL 22A

Results are presented of a study to show the effect of selecting a constant inertial attitude during the fuel dissipation phase of a return-to-launch-site abort. Results are also presented which show that the selection of the constant inertial attitude will affect the arrival point on the range-velocity target line. An alternate selection of the inertial attitude will provide control over the trajectory shape. Author

N76-33237*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
RETURN-TO-LAUNCH-SITE VARIABLE RANGE-VELOCITY LINE
R. L. Bown 6 Feb. 1976 22 p refs
(Contract NAS9-13970)
(NASA-CR-151011; DN-1.4-419) Avail: NTIS HC $3.50 CSCL 22A

The effect of moving the return-to-launch-site (RTLS) range-velocity (R-V) line closer to the landing site was studied. Results are presented which show that a five nautical mile shift in R-V line causes the last RTLS abort to occur approximately one second earlier and that the excess range capability to terminal-area-energy-management interface can be dissipated without an excessive roll angle history. Author

N76-33238*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
DISPERSION ANALYSIS FOR BASELINE REFERENCE MISSION 1
A. E. Kuhn 7 Nov. 1975 28 p refs
(Contract NAS9-31970)
(NASA-CR-151020; DN-1.4-7-17) Avail: NTIS HC $4.00 CSCL 22A

A dispersion analysis considering 3 sigma uncertainties (or perturbations) in platform, vehicle, and environmental parameters was performed for the baseline reference mission (BRM) 1 of the space shuttle orbiter. The dispersion analysis is based on the nominal trajectory for the BRM 1. State vector and performance dispersions (or variations) which result from the indicated 3 sigma uncertainties were studied. The dispersions were determined at major mission events and fixed times from lift-off (time slices) and the results will be used to evaluate the capability of the vehicle to perform the mission within a 3 sigma level of confidence and to determine flight performance reserves. A computer program is given that was used for dynamic flight simulations of the space shuttle orbiter. Author

N76-33239*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
DISPERSION ANALYSIS FOR BASELINE REFERENCE MISSION 2
L. S. Snow 14 Nov. 1975 28 p refs
(Contract NAS9-13970)
(NASA-CR-151021; DN-1.4-7-18) Avail: NTIS HC $4.00 CSCL 22A

A dispersion analysis considering uncertainties (or perturbations) in platform, vehicle, and environmental parameters was performed for baseline reference mission (BRM) 2. The dispersion analysis is based on the nominal trajectory for BRM 2. The analysis was performed to determine state vector and performance dispersions (or variations) which result from the indicated uncertainties. The dispersions are determined at major mission events and fixed times from liftoff (time slices). The dispersion results will be used to evaluate the capability of the vehicle to perform the mission within a specified level of confidence and to determine flight performance reserves. Author

N76-33240*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
DISPERSION ANALYSIS AND LINEAR ERROR ANALYSIS CAPABILITIES OF THE SPACE VEHICLE DYNAMICS SIMULATION PROGRAM
L. S. Snow and A. E. Kuhn 12 May 1975 24 p refs
(Contract NAS9-13970)
(NASA-CR-151022; DN-1.4-7-7) Avail: NTIS HC $3.50 CSCL 22A

Previous error analyses conducted by the Guidance and Dynamics Branch of NASA have used the Guidance Analysis Program (GAP) as the trajectory simulation tool. Plans are made to conduct all future error analyses using the Space Vehicle Dynamics Simulation (SVDS) program. A study was conducted to compare the inertial measurement unit (IMU) error simulations of the two programs. Results of the GAP/SVDS comparison are presented and problem areas encountered while attempting to simulate IMU errors, vehicle performance uncertainties and environmental uncertainties using SVDS are defined. An evaluation of the SVDS linear error analysis capability is also included. Author

N76-33241*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
RTLS ENTRY RANGING ANALYSIS
T. J. Crull 31 Jul. 1975 17 p refs
(Contract NAS9-13970)
(NASA-CR-151024; DN-1.4-4-11) Avail: NTIS HC $3.50 CSCL 22A

Definition of the ranging capability of a mission 3A return-to-launch-site entry is reported. The limits on downrange and crossrange are established at the initiation of RTLS entry so that terminal area energy management interface conditions were achieved satisfactorily. The downrange and crossrange limits were defined for both nominal RTLS entry conditions and a composite set of dispersed RTLS entry conditions. The results indicate a wide range of acceptable downrange and crossrange positions are available at RTLS entry initiation for nominal conditions. This is greatly reduced when dispersions are considered. For dispersed RTLS entry conditions, an 18 nautical mile range of acceptable downranges is available at zero crossrange. Author

N76-33242*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
THERMAL BOUNDARIES ANALYSIS PROGRAM DOCUMENT
M. E. Evans 30 Apr. 1975 51 p refs
(Contract NAS9-13970)
(NASA-CR-151025; DN-1.4-4-5) Avail: NTIS HC $4.50 CSCL 22A

The digital program TBAP has been developed to provide thermal boundaries in the DD/M-relative velocity (D-V), dynamic pressure-relative velocity (q-V), and altitude-relative velocity (h-V) planes. These thermal boundaries are used to design and/or analyze shuttle orbiter entry trajectories. The TBAP has been used extensively in supporting the Flight Performance Branch of NASA in evaluating candidate trajectories for the thermal protection system design trajectory. Author

N76-33243*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER VENUS-MERCURY 1973 PROJECT. VOLUME 1: VENUS AND MERCURY 1 ENCOUNTERS
15 Sep. 1976 187 p refs
(Contract NAS7-100)
(NASA-CR-148842; JPL-TM-33-734-Vol-1) Avail: NTIS HC $7.50 CSCL 22A

The primary mission report includes the Venus encounter and the first Mercury encounter. Plans and activities undertaken

to successfully achieve the mission objectives are described. Operational activities are identified by mission operation system functions, providing a brief summary of each discipline. Spacecraft performance is summarized by subsystems. Author

N76-33244*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DISTURBING EFFECTS OF ATTITUDE CONTROL MANEUVERS ON THE ORBITAL MOTION OF THE HELIOS SPACECRAFT
R. M. Georgevic 15 Sep. 1976 44 p refs
(Contract NAS7-100)
(NASA-CR-148840; JPL-TM-33-785) Avail: NTIS HC $4.00 CSCL 22A

The position of the spin axis of the Helios A spacecraft has been maintained and updated by a series of attitude control maneuvers, by means of a sequence of unbalanced jet forces which produce an additional disturbed motion of the spacecraft's center of mass. The character of this motion, its magnitude and direction was studied. For practical purposes of the orbit determination of the spacecraft, a computer program is given which shows how the components of the disturbing acceleration in the spacecraft-fixed reference frame can be easily computed. Author

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N76-33245*# McDonnell-Douglas Astronautics Co., Houston, Tex.
SIMULATION VERIFICATION TECHNIQUES STUDY. SUBSYSTEM SIMULATION VALIDATION TECHNIQUES
L. M. Duncan, J. P. Reddell, and P. B. Schoonmaker 4 Dec. 1974 461 p refs
(Contract NAS9-13657)
(NASA-CR-151005; MDC-E1201; TR-5) Avail: NTIS HC $12.00 CSCL 14B

Techniques for validation of software modules which simulate spacecraft onboard systems are discussed. An overview of the simulation software hierarchy for a shuttle mission simulator is provided. A set of guidelines for the identification of subsystem/module performance parameters and critical performance parameters are presented. Various sources of reference data to serve as standards of performance for simulation validation are identified. Environment, crew station, vehicle configuration, and vehicle dynamics simulation software are briefly discussed from the point of view of their interfaces with subsystem simulation modules. A detailed presentation of results in the area of vehicle subsystems simulation modules is included. A list of references, conclusions and recommendations are also given. Author

N76-33246*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
GROUND POWER TO FUEL CELL SWITCH-OVER STUDY
T. E. Emmons 28 Apr. 1975 10 p
(Contract NAS9-13970)
(NASA-CR-151017) Avail: NTIS HC $3.50 CSCL 22D

A functional operational description of orbiter ground power to fuel cell switch-over provisions is given. Emphasis is placed on the description of implementation, procedure and monitoring provisions associated with turn-around operation, at the Kennedy Space Center ground operations and launch facility. Author

N76-33247# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
ISEE-B EGD IM MODEL THERMOVACUUM TEST REPORT
P. Cerulli-Irelli Apr. 1976 29 p refs
(LPS-76-14) Avail: NTIS HC $4.00

The thermal vacuum chamber, a Tenney Space Jr. model, is described and the ground support equipment, stimulus equipment, and computer (a HP2116) is dealt with. The time history of the TVC test and the test itself are discussed, and the experiment check-out procedure is given. The computer programs in BASIC language are listed. During the TVC test, with the experiment operating for a total of 72 hours, no failures were detected. ESA

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N76-33248*# Martin Marietta Aerospace, Denver, Colo.
PAYLOAD/ORBITER CONTAMINATION CONTROL REQUIREMENT STUDY: SPACELAB CONFIGURATION CONTAMINATION STUDY Interim Report
L. E. Bareiss, M. A. Hetrick, E. B. Ress, and D. A. Strange 30 Sep. 1976 123 p refs
(Contract NAS8-31574)
(NASA-CR-150009; MCR-76-387) Avail: NTIS HC $5.50 CSCL 22B

The assessment of the Spacelab carrier induced contaminant environment was continued, and the ability of Spacelab to meet established contamination control criteria for the space transportation system program was determined. The primary areas considered included: (1) updating, refining, and improving the Spacelab contamination computer model and contamination analysis methodology, (2) establishing the resulting adjusted induced environment predictions for comparison with the applicable criteria, (3) determining the Spacelab design and operational requirements necessary to meet the criteria, (4) conducting mission feasibility analyses of the combined Spacelab/Orbiter contaminant environment for specific proposed mission and payload mixes, and (5) establishing a preliminary Spacelab mission support plan as well as model interface requirements; A summary of those activities conducted to date with respect to the modelling, analysis, and predictions of the induced environment, including any modifications in approach or methodology utilized in the contamination assessment of the Spacelab carrier, was presented. Author

N76-33249*# Martin Marietta Aerospace, Denver, Colo.
PAYLOAD/ORBITER CONTAMINATION CONTROL REQUIREMENT STUDY: COMPUTER INTERFACE Final Report
L. E. Bareiss, V. W. Hooper, E. B. Ress, and D. A. Strange 30 Sep. 1976 41 p
(Contract NAS8-31574)
(NASA-CR-150010; MCR-76-382) Avail: NTIS HC $4.00 CSCL 22B

A preliminary assessment of the computer interface requirements of the Spacelab configuration contamination computer model was conducted to determine the compatibility of the program, as presently formatted, with the computer facilities at MSFC. The necessary Spacelab model modifications are pointed out. The MSFC computer facilities and their future plans are described, and characteristics of the various computers as to availability and suitability for processing the contamination program are discussed. A listing of the CDC 6000 series and UNIVAC 1108 characteristics is presented so that programming requirements can be compared directly and differences noted. Author

N76-33250*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEGRADATION OF A MULTILAYER INSULATION DUE TO A SEAM AND A PENETRATION
Irving E. Sumner Washington Oct. 1976 35 p refs
(NASA-TN-D-8229; E-8622) Avail: NTIS HC $4.00 CSCL 11D

The degradation of the thermal performance of a multilayer insulation due to the presence of a seam and a penetration was studied. The multilayer insulation had 30 aluminized Mylar radiation shields with silk net spacers. The seam, an offset butt

joint, caused a heat input of 0.169 watt per meter in addition to the basic insulation thermal performance of 0.388 watt per square meter obtained before the installation of the butt joint. The penetration, a fiberglass tank support strut, provided a heat input (including the degradation of the insulation) of 0.543 watt in addition to the basic insulation thermal performance of 0.452 watt per square meter obtained before the penetration. Author

N76-33251*# Martin Marietta Aerospace, Denver, Colo.
ANALYSIS OF STRUCTURAL DYNAMIC DATA FROM SKYLAB. VOLUME 2: SKYLAB ANALYTICAL AND TEST MODAL DATA Final Report
Leonard Demchak and Harry Harcrow Aug. 1976 213 p
(Contract NAS8-31224)
(NASA-CR-2728) Avail: NTIS HC $7.75 CSCL 22B

A compendium is presented of orbital configuration test modal data, analytical test modal data, analytical test correlation modal data and analytical flight configuration 1.2 modal data. Section A presents tables showing the generalized mass contributions for each of the thirty test modes. Section B presents the two dimensional mode shape plots for the thirty test modes. Tables of GMC's for the test correlated analytical modes are presented in Section C. These analytical modes were generated from a model that was adjusted to match test results by use of the methodology discussed in Sections 2.3 and 5.4 of Volume I of this report. Section D presents the two dimensional mode shape plots for the analytical modes. Sections E and F contain the uncoupled and coupled modes of the orbital flight configuration 1.2 at three development phases of the model. Author

N76-33252# General Dynamics/Convair, San Diego, Calif.
CENTAUR INTERIM UPPER STAGE (IUS) SYSTEM STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report, 1 Oct. 1974 - 1 Jul. 1975
D. A. Heald, A. W. Nelson, R. D. Harris, and C. F. Peters 31 Jul. 1975 62 p 2 Vol.
(Contract F04701-75-C-0035)
(AD-A021401; CASD-AFS-75-006-Vol-1; SAMSO-TR-75-181-Vol-1) Avail: NTIS CSCL 22/2

The overall objective of this system study was to provide preliminary design(s), airborne and ground interface definition, substantiated life-cycle cost estimates and total program definitions for a Centaur Interim Upper Stage (IUS) System. The IUS system consists of a primary propulsive stage (a Centaur version), auxiliary propulsive stage(s) (when required), airborne support equipment, aerospace ground equipment, software, and unique facilities. Six alternative Centaur IUS programs were defined; each satisfying DOD and/or NASA requirements as specified in SAMSO document SR-IUS-100, 'Interim Upper Stage (IUS) System Requirements', Change 3, dated 4 April 1975. The IUS programs defined in the study incorporate a primary propulsive stage based on the existing D-1 Centaur vehicle used by NASA for Viking and by DOD for FleetSatComm. GRA

N76-33253# General Dynamics/Convair, San Diego, Calif.
CENTAUR INTERIM UPPER STAGE (IUS) SYSTEM STUDY. VOLUME 2: TECHNICAL Final Report, 1 Oct. 1974 - 1 Jul. 1975
D. A. Heald, A. W. Nelson, R. D. Harris, and C. F. Peters 31 Jul. 1975 358 p 2 Vol.
(Contract F04701-75-C-0035)
(AD-A021415; CASD-AFS-75-006-Vol-2; SAMSO-TR-75-181-Vol-2) Avail: NTIS CSCL 22/2

The IUS programs defined in the study incorporate a primary propulsive stage based on the existing D-1 Centaur vehicle used by NASA for Viking and by DoD for FleetSatComm. The study concludes that lowest development costs are incurred with an expendable Centaur IUS which is 89 percent existing hardware. The principal development tasks for this program would be modifications for compatibility with the Orbiter and SGLS/STDN communications. Lowest life cycle costs can be achieved with a reusable Centaur IUS where added development is required for a wide hydrogen tank and a fuel cell power supply. Trade studies and options including shorter length vehicles and compatibility with NASA planned Tracking and Data Relay Satellite (TDRSS) system are also defined. The inherent high performance of cryogenic propellants assures comfortable accommodation of current and future IUS program requirements. GRA

N76-33254# Martin Marietta Aerospace, Denver, Colo.
TITAN 3C TRANSTAGE/STAGE 2 SEPARATION-SHOCK BENCH TEST, VOLUME 1 Final Test Report, Jun. - Nov. 1975
G. E. Reed Nov. 1975 73 p 3 Vol.
(Contract F04701-75-C-0166)
(AD-A024560; MCR-75-425-Vol-1; SAMSO-TR-76-107-Vol-1) Avail: NTIS CSCL 13/5

A series of pyrotechnic shock tests were conducted to evaluate several concepts of shock attenuation. The investigation was occasioned by the results of full-scale pyrotechnic shock tests of a Titan IIIC Transtage (the fourth stage of a four-stage launch vehicle). These tests, reported in MCR-75-414, investigated shock levels on truss structure supporting guidance and vehicle control equipment. The shock energy source was the pyrotechnically actuated nuts that separate Stage II from the Transtage. In general, the test data showed shock levels on the trusses in the frequencies near 2000 Hz to be higher than anticipated. Shock attenuation concepts were investigated to provide a springboard for Titan IIIC hardware changes that would reduce shock levels on critical components. Three means of shock attenuation have been demonstrated. Although the effort was to support the solution of a particular problem, the test results are generally applicable in the industry. The concepts tested are only those that would provide an economically acceptable means of solving the particular problem. GRA

N76-33255# Martin Marietta Aerospace, Denver, Colo.
TITAN 3C TRANSTAGE/STAGE 2 SEPARATION-SHOCK BENCH TEST, VOLUME 2 Final Test Report, Jun. - Nov. 1975
G. E. Reed Nov. 1975 186 p refs 3 Vol.
(Contract F04701-75-C-0166)
(AD-A024561; MCR-75-425-Vol-2; SAMSO-TR-76-107-Vol-2) Avail: NTIS CSCL 13/5

Analytical studies were conducted to determine the feasibility of proposed concepts for shock attenuation. To support full and partial shock isolation of the guidance truss, vibration, loads and misalignment studies were completed that indicated that all related design constraints were met. Considerable analytical effort was required to size truss isolators, which led to isolator verification shock and vibration tests before the actual bench test series. Proposed shock attenuation concepts of truss structural modification, incorporation of shims at skirt attachment points, and torque variations on explosive bolts were found structurally feasible. Component isolation of the Missile Guidance Computer and Inertial Measurement Unit was found to be technically feasible except for thermal problems. This volume summarizes the analyses associated with the bench test program for the Titan IIIC Transtage Inertial Guidance System (IGS) truss. The volume includes total truss isolation, component isolation, IGS truss analysis, miscellaneous shock attenuation and dissipation analyses; results of supporting isolator vibration and shock tests; and separation nut studies. GRA

N76-33256# Martin Marietta Aerospace, Denver, Colo.
TITAN 3C TRANSTAGE/STAGE 2 SEPARATION-SHOCK BENCH TEST, VOLUME 3 Final Test Report, Jun. - Nov. 1975
G. E. Reed Nov. 1975 821 p refs 3 Vol.
(Contract F04701-75-C-0166)
(AD-A024562; MCR-75-425-Vol-3; SAMSO-TR-76-107-Vol-3) Avail: NTIS CSCL 13/5

A series of pyrotechnic shock tests were conducted to evaluate several concepts of attenuating the shock generated by the pyrotechnically actuated nuts during Transtage separation on the Titan IIIC launch vehicle. An orifice installed between the pyrotechnic device and the separation mechanism piston reduced shock levels by approximately 40%. This volume contains the shock response spectra from each of the 15 accelerometers for all 51 test runs. GRA

N76-33257# Auburn Univ., Ala. Engineering Experiment Station.
INVESTIGATION OF FACTORS WHICH CONTRIBUTE TO

THE MALLAUNCH OF FREE ROCKETS Final Report, 1 Oct. 1974 - 31 Dec. 1975
John E. Cochran, Jr. 30 Jan. 1976 205 p refs
(Grant DAHC04-75-G-0034)
(AD-A024570; ARO-12857.1-R-E) Avail: NTIS CSCL 19/7

Results of an investigation concerned with evaluating factors which contribute to the mallaunch of free rockets are reported. Modifications to a previously developed digital computer code which simulates the dynamics of a single-round rocket/launcher, from the time the rocket is at rest on the launcher until it impacts, are described. These modifications make the simulation much more realistic. A new 'rigid-constraints' model for a single-round rocket/launcher system is described and vector/matrix methods are used to obtain matrix ordinary differential equations which govern the system's motion. A digital computer code which implements the numerical solution of these equations is included. Both codes (modified and new) are very general and provide for modeling the effects of launcher motions, rocket dynamic unbalance, thrust malalignment, winds, rocket aerodynamics and variable rocket inertia characteristics. The new code also provides the capability for modeling jet damping and requires less computer time than the modified code. Typical simulation results are presented. Pitch data from two free rocket test flights are compared with simulation results. It is concluded that dynamic unbalance and/or thrust malalignment affected the motions of the two rockets considered, but that other factors of uncertain origin were also presented. Recommendations for further study are made. Author (GRA)

N76-33258# Auburn Univ., Ala. Dept of Aerospace Engineering.
INVESTIGATION OF FACTORS WHICH CONTRIBUTE TO MALLAUNCH OF FREE ROCKETS
John E. Cochran, Jr. Oct. 1975 84 p refs
(Grant DAHC04-75-G-0034; DA Proj. 1M3-62303-A-214)
(AD-A023820; RL-CR-76-4) Avail: NTIS CSCL 19/7

The simulation of the motion of a single-round launcher/rocket system during launch, transition to free flight, and free flight of the rocket is considered. A simple physical model for the system is described. The model consists of an arbitrary rigid body launcher, with 3 deg of rotational freedom, and an arbitrary rigid body rocket, which is attached to the launcher during the spin up if applicable, detent, and guidance phases by 'springs.' These springs are intended to model the flexibility and damping characteristics of the rocket's shoes or the interface between the rocket and the tube of a tube type launcher. The model also includes the effects of thrust malalignment, tipoff, variable thrust, and spin torque programs and friction. Using modern vector/matrix algebra, the vector equations are converted to matrix equations, amenable to digital programming and solution. Results of preliminary simulation runs made using a computer code written to perform the required numerical integration are presented and discussed. Author (GRA)

N76-33259# Analytic Sciences Corp., Reading, Mass.
DIRECT STATISTICAL ANALYSIS OF MISSILE GUIDANCE SYSTEMS VIA CADET (TRADE NAME) - Final Technical Report, 1 Feb. 1973 - 31 Dec. 1975
James H. Taylor and Charles F. Price 15 Mar. 1976 231 p refs
(Contract N00014-73-C-0213; NR Proj. 215-214)
(AD-A022631; TASC-TR-385-3) Avail: NTIS CSCL 17/7

The Covariance Analysis Describing Function Technique (CADET) -- a technique conceived at TASC for the efficient direct statistical analysis of nonlinear systems with random inputs -- is applied to the study of a complicated, highly nonlinear model for a tactical missile homing guidance system. Numerous parameter sensitivity studies are performed, with selected cases verified by the Monte Carlo method. The validity of the assumptions underlying the CADET theory is investigated, and the impact of possible errors in these assumptions on the accuracy of CADET is assessed. In every realistic situation studied, CADET provides accurate missile performance projections with a small fraction of the computer time required for a comparably reliable Monte Carlo analysis. GRA

N76-33260# Naval Research Lab., Washington, D.C.
A METHOD FOR THE DIRECT MEASUREMENT OF THE FORCE ON A SATELLITE DUE TO ELECTROMAGNETIC RADIATION Final Report
Louis Sica 9 Mar. 1976 47 p refs
(RR0110741)
(AD-A022840; NRL-7961) Avail: NTIS CSCL 20/6

A technique was devised to measure the force on a satellite due to solar electromagnetic radiation pressure. The method consists of hanging the satellite as a pendulum and driving it on resonance with the light from a chopped solar simulator. From the measured amplitude of oscillation for a given number of cycles of driven motion, the driving force amplitude may be computed. The success of the method depends on the use of an optomechanical system which is insensitive to noise vibrations introduced at the pendulum pivot. The system consists of the satellite pendulum plus another pendulum of equal period and mass suspended from an upper hanging platform. The relative coordinate of the satellite and its twin, which can be measured optically, is independent of the motion of the ceiling. Engineering tolerances for the optical and mechanical components of the device are treated in detail. Author (GRA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N76-33261*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
THERMAL APU/HYDRAULICS ANALYSIS PROGRAM. USER'S GUIDE AND PROGRAMMER'S MANUAL
T. A. DeLuna 1 Oct. 1976 257 p ref
(Contract NAS9-14960)
(NASA-CR-150993; DN-1.4-7-45) Avail: NTIS HC $9.00 CSCL 22B

The User's Guide information plus program description necessary to run and have a general understanding of the Thermal APU/Hydraulics Analysis Program (TAHAP) is described. This information consists of general descriptions of the APU/hydraulic system and the TAHAP model, input and output data descriptions, and specific subroutine requirements. Deck setups and input data formats are included and other necessary and/or helpful information for using TAHAP is given. The math model descriptions for the driver program and each of its supporting subroutines are outlined. Author

N76-33262*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
DRAG BIAS FEEDBACK FOR THE ANALYTIC DRAG CONTROL ENTRY GUIDANCE SYSTEM
H. C. Kyle 24 Sep. 1976 67 p refs
(Contract NAS9-14960)
(NASA-CR-150994; DN-1.4-4-22) Avail: NTIS HC $4.50 CSCL 22B

The Analytic Drag Control (ADC) entry guidance has been developed and baselined for the space shuttle orbiter entry. A method is presented which corrects the orbiter entry guidance commanded bank angle for biases between navigated drag and guidance computed reference drag. This is accomplished by an integral feedback technique, which uses the drag bias information to adjust the difference between navigated and reference altitude rate used by the ADC guidance. The method improves the capability of the ADC guidance system by compensating for any error source which causes a bias between the navigated drag and reference drag profile. These errors include navigated altitude rate errors, atmosphere dispersions, and roll attitude deadband effects. A discussion of the method and results of digital computer entry simulations is presented. Author

N76-33263*# Chrysler Corp., New Orleans, La. Space Div.
INVESTIGATIONS OF THE 0.020-SCALE 88-OTS INTEGRATED SPACE SHUTTLE VEHICLE JET-PLUME MODEL IN THE NASA/AMES RESEARCH CENTER 11 BY 11-FOOT UNITARY PLAN WIND TUNNEL (IA80), VOLUME 1
M. E. Nichols (Rockwell Intern.) Sep. 1976 899 p

(Contract NAS9-13247)
(NASA-CR-147632; DMS-DR-2212-Vol-1) Avail: NTIS HC $21.25 CSCL 22B

The results are documented of jet plume effects wind tunnel test of the 0.020-scale 88-OTS launch configuration space shuttle vehicle model in the 11 x 11 foot leg of the NASA/Ames Research Center Unitary Plan Wind Tunnel. This test involved cold gas main propulsion system (MPS) and solid rocket motor (SRB) plume simulations at Mach numbers from 0.6 to 1.4. Integrated vehicle surface pressure distributions, elevon and rudder hinge moments, and wing and vertical tail root bending and torsional moments due to MPS and SRB plume interactions were determined. Nozzle power conditions were controlled per pretest nozzle calibrations. Model angle of attack was varied from -4 deg to +4 deg; model angle of sideslip was varied from -4 deg to +4 deg. Reynolds number was varied for certain test conditions and configurations, with the nominal freestream total pressure being 14.69 psia. Plotted force and pressure data are presented. Author

N76-33264*# Chrysler Corp., New Orleans, La. Space Division.
INVESTIGATIONS OF THE 0.020-SCALE 88-OTS INTEGRATED SPACE SHUTTLE VEHICLE JET-PLUME MODEL IN THE NASA/AMES RESEARCH CENTER 11 BY 11-FOOT UNITARY PLAN WIND TUNNEL (IA80), VOLUME 2
M. E. Nichols (Rockwell Intern. Space Div., Downey, Calif.) Sep. 1976 1053 p 4 Vol.
(Contract NAS9-13247)
(NASA-CR-147633; DMS-DR-2212-Vol-2) Avail: NTIS HC $28.25 CSCL 22B

Tabulated force and pressure data are presented for the orbiter base and fuselage. For abstract, see N76-33263. J.M.S.

N76-33265*# Chrysler Corp., New Orleans, La. Space Division.
INVESTIGATIONS OF THE 0.020 SCALE 88-OTS INTEGRATED SPACE SHUTTLE VEHICLE JETPLUME MODEL IN THE NASA/AMES RESEARCH CENTER 11 BY 11-FOOT UNITARY PLAN WIND TUNNEL (IA80), VOLUME 3
M. E. Nichols (Rockwell Intern. Space Div., Downey, Calif.) Sep. 1976 843 p 4 Vol.
(Contract NAS9-13247)
(NASA-CR-147634; DMS-DR-2212-Vol-3) Avail: NTIS HC $21.25 CSCL 22B

Tabulated pressure data are presented for the orbiter fuselage, the orbiter bodyflap upper surface, and the orbiter bodyflap lower surface. For abstract, see N76-33263. J.M.S.

N76-33266*# Chrysler Corp., New Orleans, La. Space Division.
INVESTIGATIONS OF THE 0.020-SCALE 88-OTS INTEGRATED SPACE SHUTTLE VEHICLE JETPLUME MODEL IN THE NASA/AMES RESEARCH CENTER 11 BY 11-FOOT UNITARY PLAN WIND TUNNEL (IA80), VOLUME 4
M. E. Nichols (Rockwell Intern. Space Div., Downey, Calif.) Sep. 1976 833 p 4 Vol.
(Contract NAS9-13247)
(NASA-CR-147635; DMS-DR-2212-Vol-4) Avail: NTIS HC $21.25 CSCL 22B

Tabulated pressure data are presented for the external tank and the external tank base. For abstract, see N76-33263.J.M.S.

N76-33267*# Chrysler Corp., New Orleans, La. Space Div.
AN EXPERIMENTAL DETERMINATION IN CALSPAN LUDWIEG TUBE OF THE BASE ENVIRONMENT OF THE INTEGRATED SPACE SHUTTLE VEHICLE AT SIMULATED MACH 4.5 FLIGHT CONDITIONS (TEST IH5 OF MODEL 19-OTS)
R. F. Drzewiecki (Calspan Corp., Buffalo, N. Y.) and J. W. Foust (Rockwell Intern. Corp., Downey, Calif.) Oct. 1976 300 p refs
(Contract NAS9-13247)
(NASA-CR-147636; DMS-DR-2308) Avail: NTIS HC $9.25 CSCL 22B

A model test program was conducted to determine heat transfer and pressure distributions in the base region of the space shuttle vehicle during simulated launch trajectory conditions of Mach 4.5 and pressure altitudes between 90,000 and 210,000 feet. Model configurations with and without the solid propellant booster rockets were examined to duplicate pre- and post-staging vehicle geometries. Using short duration flow techniques, a tube wind tunnel provided supersonic flow over the model. Simultaneously, combustion generated exhaust products reproduced the gasdynamic and thermochemical structure of the main vehicle engine plumes. Heat transfer and pressure measurements were made at numerous locations on the base surfaces of the 19-OTS space shuttle model with high response instrumentation. In addition, measurements of base recovery temperature were made indirectly by using dual fine wire and resistance thermometers and by extrapolating heat transfer measurements. Author

N76-33268*# Chrysler Corp., New Orleans, La.
RESULTS OF TESTS CS4 AND CS5 TO INVESTIGATE DYNAMIC LOADS AND PRESSURES ON 0.03-SCALE MODELS (AX1319-3/4 AND 45-0) OF MATED 747 CAM AND SPACE SHUTTLE ORBITER IN THE BOEING TRANSONIC WIND TUNNEL
Oct. 1976 106 p refs Prepared jointly with Boeing Aerospace Co.
(Contract NAS9-13247)
(NASA-CR-147638; DMS-DR-2341) Avail: NTIS HC $5.50 CSCL 22B

A 0.03-scale model of the 747 CAM/Orbiter was tested in an 8 x 12 foot transonic wind tunnel. Dynamic loads, pressure, and empennage flow field data were obtained using pressure transducers, strain gages, and a split film anemometer. The test variables included Mach number, angle of attack, sideslip angle, orbiter tailcone on and off, orbiter partial tailcone, orbiter nozzle air scoops, orbiter body flap angle, and orbiter elevon angle. Author

N76-33269*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE SHUTTLE EVA OPPORTUNITIES
Daniel A. Bland, Jr. 1976 22 p Original contains color illustrations
(NASA-TM-X-74152; JSC-11391) Avail: NTIS HC $3.50 CSCL 22A

A technology assessment is presented on space extravehicular activities (EVA) that will be possible when the space shuttle orbiter is completed and launched. The use of EVA in payload systems design is discussed. Also discussed is space crew training. The role of EVA in connection with the Large Space Telescope and Skylab are described. The value of EVA in constructing structures in space and orbital assembly is examined. Excellent color illustrations are provided which show the proposed EVA functions that were described. J.R.T.

N76-33270*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LARGE-PAYLOAD EARTH-ORBIT TRANSPORTATION WITH ELECTRIC PROPULSION
J. W. Stearns 15 Sep. 1976 51 p refs
(Contract NAS7-100)
(NASA-CR-148973; JPL-TM-33-793) Avail: NTIS HC $4.50 CSCL 22A

Economical unmanned earth orbit transportation for large payloads is evaluated. The high exhaust velocity achievable with electric propulsion is attractive because it minimizes the propellant that must be carried to low earth orbit. Propellant transport is a principal cost item. Electric propulsion subsystems utilizing advanced ion thrusters are compared to magnetoplasmadynamic (MPD) thrust subsystems. For very large payloads, a large lift vehicle is needed to low earth orbit, and argon propellant is required for electric propulsion. Under these circumstances, the MPD thruster is shown to be desirable over the ion thruster for earth orbit transportation. Author

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N76-33271# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
CELESTIAL ASPECT SENSOR SYSTEM Instrumentation Papers
Russell G. Steeves, Henry A. Miranda, Jr., and John Dulchinos 20 Nov. 1975 31 p
(AF Proj. 7659)
(AD-A022672; AFCRL-TR-75-0596; AFCRL-IP-242) Avail: NTIS CSCL 17/7

A system was developed to determine rocket payload attitude with respect to a star field. The system operates under day or night conditions; it gives attitude within 0.1 deg updated 10 times/sec. It relays this information via a digital bit stream, requiring less than 4 kHz of telemetry bandwidth. The system is capable of detecting stars of +3 1/2 magnitude and is relatively immune to airglow, zodiacal light, or uniform background lighting. Author (GRA)

N76-33272# Stanford Univ., Calif. Inst. for Communication Research.
TELEMEDICINE IN ALASKA: THE ATS-6 SATELLITE BIOMEDICAL DEMONSTRATION Final Report, May 1974 - May 1975
Dennis Foote, Dewin Parker, and Heather Hudson Feb. 1976 259 p refs
(Contract NO1-LM-3-4734)
(PB-250983/4; NIH-NO1-LM-3-4734) Avail: NTIS HC $9.00 CSCL 06E

The final report of the evaluation of the ATS-6 biomedical demonstration in Alaska, one of several health education telecommunications demonstrations on that satellite is summarized. The demonstration project explored the potential of satellite video consultation to improve the quality of rural health care in Alaska. A centralized, computer based problem oriented medical record system was introduced. One chapter covers telemedicine, others cover performance and use of the demonstrations system, attitudes of users, effects on medical outcomes, and implications for future use. GRA

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N76-33273*# TRW Systems Group, Redondo Beach, Calif.
PHASE B-FINAL DEFINITION AND PRELIMINARY DESIGN STUDY FOR THE INITIAL ATMOSPHERIC CLOUD PHYSICS LABORATORY (ACPL). A SPACELAB MISSION PAYLOAD Interim Report
23 Sep. 1976 289 p
(Contract NAS8-31844)
(NASA-CR-150017) Avail: NTIS HC $9.25 CSCL 22B

Progress in the development of the Atmospheric Cloud Physics Laboratory is outlined. The fluid subsystem, aerosol generator, expansion chamber, optical system, control systems, and software are included. D.M.L.

N76-33274*# Chrysler Corp., New Orleans, La. Space Div.
LOW-SUBSONIC STABILITY AND CONTROL CHARACTERISTICS OF A 0.015-SCALE REMOTELY CONTROLLED ELEVON MODEL (44-0) OF THE SPACE SHUTTLE ORBITER IN THE LANGLEY RESEARCH CENTER LOW TURBULENCE PRESSURE TUNNEL (LA61B)
Sep. 1976 316 p
(Contract NAS9-13247)
(NASA-CR-147629; DMS-DR-2300) Avail: NTIS HC $9.75 CSCL 22B

A Langley-built 0.015-scale SSV orbiter configuration with remote independently operated left and right elevon surfaces was tested in the NASA/Langley Research Center Low Turbulence Pressure Tunnel. A detailed aerodynamic data base was obtained for the current shuttle orbiter configuration. Special attention was directed to definition of Reynolds number effects on nonlinear aerodynamic characteristics of the orbiter. Small increments in angle of attack, sideslip, and elevon/aileron position were studied in order to better define areas where nonlinearities may occur. Force and moment, and elevon position data were recorded over an angle of attack range -2 deg to 20 deg at angles of sideslip of 0 deg , + or - 2 deg, and + or - 4 deg. Tests were also made over an angle of sideslip range of -6 deg to 6 deg at selected angles of attack and elevon/aileron position. The test Mach numbers were from 0.15 to 0.30 at Reynolds numbers from 2.0 to 13.5 million per foot. Author

N76-33275*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF A FLOW FIELD SURVEY CONDUCTED USING THE 0.0175 SCALE ORBITER MODEL 29-0 IN AEDC VKF TUNNEL B DURING TEST OH52
B. J. Herrera (Rockwell Intern. Corp., Downey, Calif.) Sep. 1976 214 p refs
(Contract NAS9-13247)
(NASA-CR-147637; DMS-DR-2330) Avail: NTIS HC $7.75 CSCL 01A

Static pressure data and flow field surveys of the boundary layer and shock layer on the lower surface of a 0.0175 scale model of the space shuttle orbiter were obtained in a hypersonic wind tunnel. The tests were conducted at Mach number 7.9 and Reynolds number based on the model length of 1.3 x 1 million to simulate atmospheric entry. Twenty-six stations were surveyed at 30 and 35 degree angles of attack. Author

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N76-33276*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
A DETAILED DESCRIPTION OF THE SEQUENTIAL PROBABILITY RATIO TEST FOR 2-IMU FDI
T. M. Rich 24 Mar. 1976 30 p refs
(Contract NAS9-13970)
(NASA-CR-151013; DN-D0410-007) Avail: NTIS HC $4.00 CSCL 22B

The sequential probability ratio test (SPRT) for 2-IMU FDI (inertial measuring unit failure detection/isolation) is described. The SPRT is a statistical technique for detecting and isolating soft IMU failures originally developed for the strapdown inertial reference unit. The flowchart of a subroutine incorporating the 2-IMU SPRT is included. Author

N76-33277*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
TWO-IMU FDI PERFORMANCE OF THE SEQUENTIAL PROBABILITY RATIO TEST DURING SHUTTLE ENTRY
T. M. Rich 31 Mar. 1976 22 p refs
(Contract NAS9-13970)
(NASA-CR-151014; DN-D0410-008) Avail: NTIS HC $3.50 CSCL 22B

Performance data for the sequential probability ratio test (SPRT) during shuttle entry are presented. Current modeling constants and failure thresholds are included for the full mission 3B from entry through landing trajectory. Minimum 100

percent detection/isolation failure levels and a discussion of the effects of failure direction are presented. Finally, a limited comparison of failures introduced at trajectory initiation shows that the SPRT algorithm performs slightly worse than the data tracking test. Author

N76-33278*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
TRACKING SUBSYSTEM TEST REQUIREMENTS SURVEY
D. H. Orr, C. G. Tatosian, M. C. Bynum, and A. W. Zook 17 Mar. 1975 40 p refs
(Contract NAS9-13970)
(NASA-CR-151016; DN-1.3-DN-C0201-002) Avail: NTIS HC $4.00 CSCL 22B

A survey of the test and checkout requirements of the tracking portion of the communications and tracking subsystem was performed to evaluate adequacy of planned tests and test requirement documents. Emphasis is placed on identifying test completeness, duplications, and omissions. Items that may save time, aid in testing, and present a more complete integrated test program are also noted. The results of this survey are summarized. Author

N76-33279*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
STAR TRACKER AXIS-TO-SUNLIT EARTH HORIZON ANGLE CONSTRAINT EVALUATIONS FOR RENDEZVOUS OPERATIONS
W. L. Hutchison 28 Mar. 1975 40 p refs
(Contract NAS9-13970)
(NASA-CR-151023) Avail: NTIS HC $4.00 CSCL 17G

The results are presented of a study initiated to evaluate the star tracker axis-to-sunlit earth horizon angle constraint with respect to limitations imposed on the passive target rendezvous capability. The data presented include considerations for dispersions and sensor pointing capabilities and generalizations with respect to the uncertainties associated with the angle constraint available in practice. Author

N76-33280# Rockwell International Corp., Anaheim, Calif. Autonetics Group.
EFFECTS OF TRANSIENT BEHAVIOR DURING MINUTEMAN IMU CALIBRATION
J. A. Estrada Jun. 1976 10 p Presented to AIAA Guidance and Control Conf., San Diego, Calif., 16-18 Aug. 1976 Sponsored by USAF
(X76-753/201) Avail: NTIS HC $3.50

Some results of studies of transient phenomena in a gyrocompass and alignment assembly, which is the primary azimuth and level reference for the inertial measuring unit of the Minuteman navigation system, were described. The assembly is examined under the thermal change and repositioning environment occurring during a system calibration mode of operation. The response and characterization of the system to transient environments are derived from the summation of subcomponent responses by applying the principle of superposition. The response is expressed in terms of its time constants. These time constants are used to correlate the system behavior with subcomponent behavior which was characterized under a simulated-system environment. Further examination of experimental and analytical modelling illustrates how physical interpretation of time constants is possible. Author

N76-33281*# Bendix Corp., Detroit, Mich. Guidance Systems Div.
ANALYTICAL STUDY OF THE INSIDE-OUT GIMBAL DYNAMICS. VOLUME 1: ANALYTICAL STUDY OF INSIDE-OUT/COINCIDENT GIMBAL DYNAMICS Final Report
S. Calvin Rybak Sep. 1976 402 p 2 Vol.
(Contract NAS8-31629)
(NASA-CR-150025) Avail: NTIS HC $11.00 CSCL 14B

The performance capabilities and limitations of the instrument pointing system (IPS) are described. Suggestions of design modifications that result in overall improved IPS performance are included. Since the design and configuration of the IPS was modified a portion of the study was performed with the inside-out Gimbal configuration which was updated to the present coincident Gimbal system configuration. Due to the similarity of the two systems, the results obtained for the inside-out Gimbal also apply to the coincident Gimbal system. Author

N76-33282*# Bendix Corp., Detroit, Mich. Guidance Systems Div.
ANALYTICAL STUDY OF INSIDE-OUT GIMBAL DYNAMICS. VOLUME 2: APPENDIX Final Report
S. Calvin Rybak Sep. 1976 445 p 2 Vol.
(Contract NAS8-31629)
(NASA-CR-150026) Avail: NTIS HC $11.75 CSCL 14B

Stability data, eigenvalue data, and instrument pointing system earth point tracking time histories at various orbital altitudes are presented. These data apply to the inside-out Gimbal system configuration and the coincident Gimbal system configuration. Author

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N76-33283*# Hughes Research Labs., Malibu, Calif. Ion Physics Dept.
THE 2.5 kW ADVANCED TECHNOLOGY ION THRUSTER Final Report, 13 Jun. 1974 - 29 Feb. 1976
R. L. Poeschel Apr. 1976 106 p refs
(Contract NAS3-17831)
(NASA-CR-135076) Avail: NTIS HC $5.50 CSCL 21C

A representative thruster was extensively documented with respect to performance parameters and characteristics at selected ion beam currents in the 0.5 to 2.75 A range, including measurements of thrust losses resulting from doubly-charged ions and ion beam divergence. Corrected total efficiency was shown to be relatively insensitive to operating parameter selection at any given power level. Factors affecting doubly-charged ionization were studied and it was found that the fraction of doubly-charged ions is directly proportional to the discharge chamber propellant utilization. The parameter that most affects this proportionality is the accel aperture diameter (which controls neutral atom loss). Thruster-power conditioner interactions were studied with the result that previous power supply specifications remain satisfactory. Options for reducing the number of power supplies required were demonstrated to be feasible. Gimbal actuator designs were studied with the goal of selecting a particular approach for design and development. The conclusion drawn was that optimum gimbal actuator design depends heavily on the thruster application and consequently the effort was concluded by developing a computer program to aid in specifying the gimbal requirements for the thrust vectoring required in a specific application. Author

N76-33284# Politecnico di Torino (Italy). Ist. di Macchine e Motori per Aeromobili.
PROJECT OF LIQUID RADIATORS FOR USE IN AN AUXILIARY POWER DEVICE ONBOARD SPACE VEHICLES [PROGETTO DI RADIATORI A LIQUIDO PER IMPIEGO IN UN IMPIANTO DI POTENZA AUSILIARIA A BORDO DI VEICOLI SPAZIALI]
Paolo Campanaro and Nicola Nervegna Feb. 1975 39 p refs In ITALIAN
(Publ-167) Avail: NTIS HC $4.00

A mathematical model for a liquid radiator is presented for use onboard spacecraft. The radiator has an Al panel with tubes in which silicone oil flows, and its geometry and thermal characteristics are described. Three examples of auxiliary power units (radioisotopic, nuclear, solar) to which the radiator could be applied are considered. ESA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N76-33285*# Boeing Co., Huntsville, Ala. Nuclear and Space Physics Dept.
UNDERCOOLING OF MATERIALS DURING SOLIDIFICATION IN SPACE Final Report
R. I. Miller 31 Aug. 1976 106 p refs
(Contract NAS8-31238)
(NASA-CR-150011; D256-10202) Avail: NTIS HC $5.50 CSCL 11G

A theoretical research program was undertaken on the under cooling and solidification of materials under variable external field conditions. A catalog of theories and models of nucleation of solid phases in the melt is provided, as is a discussion of the relation of undercooling to intermolecular potentials, the dependence of growth rate on undercooling, the influence of undercooling on liquid-solid interface stability and solid structure, the direct effects of external fields on melts, the relation of solid physical properties to structure and the role of nucleants in solidification. Results of the theoretical analysis of several experiments related to the space processing applications program are given, and recommendations for future experiments and further theoretical developments along with procedures for correlation of theory and experiment are specified. Author

N76-33286# Stanford Research Inst., Menlo Park, Calif.
OXIDATION OF SULFUR AND AMINE MODEL COMPOUNDS Quarterly Progress Report, Jun. - Aug. 1975
Theodore Mill and Constance W. Gould Jan. 1976 17 p refs
(Contract DAAA15-74-C-0150; DA Proj. 1W7-62710-AD-60)
(AD-A022213; SRI-PYU-3280-5; EC-CR-76050) Avail: NTIS CSCL 07/3

Photon flux in the spectral absorption band of Rose bengal (RB) (480-570 nm) is approximately 3 times 10 to the -6th power mole/sq cm min or about 0.5 mg Bu2S converted/sq cm min. Experiments with thin films of Bu2S sensitized by polymer bound Rose bengal (PRB) give conversions up to 0.06 mg/sq cm min. A solution of tetramethylethylene photooxygenated at a rate of 7 times 10 to the -7th power mole/sq cm min. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N76-33287*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MICROSTRUCTURE OF HOT-PRESSED Al2O3-Si3N4 MIXTURES AS A FUNCTION OF HOLDING TEMPERATURE
Hun C. Yeh 1976 12 p refs Presented at the 6th Intern. Materials Symp., Berkeley, Calif., 24-27 Aug. 1976
(NASA-TM-X-73482) Avail: NTIS HC $3.50 CSCL 11D

Powder mixtures of 40 m/o Si3N4-60 m/o Al2O3 were hot-pressed at 4000 psi at various holding temperatures from 1100 C to 1700 C. Scanning Electron Microscopy and Transmission Electro Microscopy results were correlated to X-ray phase analysis and density measurements. The progressively developed microstructure was used to interpret the densification behavior of SiAlON. Photomicrographs of microstructures are shown.
Author

N76-33288*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
STRESS-STRAIN AND FAILURE PROPERTIES OF GRAPHITE/EPOXY LAMINATES
Y. T. Yeow and H. F. Brinson Sep. 1976 38 p refs
(Grant NsG-2038)
(NASA-CR-148812; VPI-E-76-21) Avail: NTIS HC $4.00 CSCL 11D

The results of a series of tensile tests on graphite/epoxy laminates at rates varying from 0.002 in/min to 2 in/min are reported. The loads are applied at various angles to the fiber directions in each case. The rate dependent behavior of the stress-strain response is assessed. Evidence is presented to indicate that failure first occurs on inner piles. Also, evidence is presented to indicate that, in some cases, moduli increase with increased stress or strain level. The lamination theory is used to predict moduli and comparisons with experiment are given. Also, the lamination theory is used in conjunction with three failure theories to predict ultimate strengths with varying degrees of success. Author

N76-33289*# Scientific Translation Service, Santa Barbara, Calif.
THE APPLICATION OF BIMETALLIC AND REINFORCED ALUMINUM-STEEL COMBINATIONS
V. R. Ryabov Washington NASA Oct. 1976 306 p refs Transl. into ENGLISH of the book "Primeneniye bimetallicheskikh i armirovannykh stalealyuminiyevykh soyedineniy", Metallurgiya Press, Moscow, 1975 p 1-288
(Contract NASw-2791)
(NASA-TT-F-17105) Avail: NTIS HC $9.75 CSCL 11D

The properties and methods of production of construction materials incorporating metals with sharply differing physiochemical and mechanical properties are discussed. Special attention is given to laminates and composites of steel and aluminum or its alloys. The theoretical and experimentally determined strengths of aluminum reinforced with fibers of stainless steel are compared and analyzed. Methods of improving the strength and low and high temperature performance of such materials are examined. The use of bimetallic and reinforced materials for specific construction purposes is discussed. Author

N76-33290*# Scientific Translation Service, Santa Barbara, Calif.
ON THE CREEP-RUPTURE STRENGTH OF W COMPOSITE CAST WITH SOME HEAT RESISTANT ALLOYS
T. Arai and R. Yoda Washington NASA Sep. 1976 11 p refs Transl. into ENGLISH from Journal of the Japan Inst. of Metals (Japan), v. 35, Nov. 1971 p 1050-1055
(Contract NASw-2791)
(NASA-TT-F-17209) Avail: NTIS HC $3.50 CSCL 11D

Tests were made to measure the creep-rupture strength of a composite material consisting of molybdenum cast with two heat-resistant alloys: Nimonic 90, with a nickel radical, and S-816, with a cobalt radical. The casting temperature was 100 C higher than the temperature (1600 C) used for the molybdenum cores. Material cast with six passes whose workability was 36% was taken as the creep rupture test fragment. Microstructures of sample cross sections in the cast state and samples subjected to swag processing are given. Hardness measurements were also taken. The creep rupture strength in air at 1,000-1,200 C was found to be exceedingly higher than that of the alloy coatings or the molybdenum core itself. A tentative reciprocal relation was confirmed between the creep rupture life and the secondary creep rate at 1,000-1,200 C. Complete adhesion in air readily occurred between the solid molybdenum and the heat resistant alloys. Y.J.A.

N76-33291*# Scientific Translation Service, Santa Barbara, Calif.
SINTERING PROCESS AND RADIAL COMPRESSIVE STRENGTH OF Fe/Sn AND Fe/Cu/Sn COMPACTS
F. Esper, K. H. Friese, and R. Zeller Washington NASA Sep. 1976 16 p refs Transl. into ENGLISH from Bosch Tech. Ber. (West Germany), v. 2, no. 5, Nov. 1968 p 227-234
(Contract NASw-2791)
(NASA-TT-F-17229) Avail: NTIS HC $3.50 CSCL 11D

The change of volume of Fe/Sn and Fe/Cu/Sn specimens as a function of temperature was investigated by means of a dilatometer. The breaks in the dilatometer curve coincide with temperatures characterized by phase transitions, as shown by X-ray diffraction and metallographic examination. From the dilatometer curve and the phase diagram of the particular system, a comprehensive interpretation of the sintering reactions occurring can be given. From this, it is possible to explain the radial compressive strength, the tensile strength and the hardness of the specimens. Author

N76-33292*# Scientific Translation Service, Santa Barbara, Calif.
COMPOSITE MATERIALS, 1
Taichi Fujii Washington NASA Oct. 1976 16 p refs Transl.

into ENGLISH from J. Japan Soc. Mater. Sci., v. 24, Dec. 1975 p 1153-1157
(Contract NASw-2791)
(NASA-TT-F-17242) Avail: NTIS HC $3.50 CSCL 11D

The basic definition of a composite material is examined and the main types of composites are characterized. Particle dispersed composite material, fiber reinforced composites (with either discontinuous fibers or continuous fibers arranged unidirectionally or in cross-ply), and laminated composites are considered. Tables are presented showing the mechanical properties (density, tensile strength, specific strength, tensile modulus, and specific modulus) for the most common materials used for fiber (including aluminum, titanium, steel, beryllium, E glass, S glass, carbon, and boron), for whisker (including copper, nickel, iron, B4C, and SiC, and graphite), and for the matrix (including thermoplastics such as nylon, polycarbonate, polystyrene, and metacryl, the thermoset plastic polyester, and aluminum and copper). The fiber efficiency was calculated for reinforced plastics under different fiber orientations, fiber lengths, fiber volume fractions, composite strength, and fiber stress.
Author.

N76-33293*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF ANGLEPLYING AND MATRIX ENHANCEMENT ON IMPACT-RESISTANT BORON/ALUMINUM COMPOSITES
David L. McDanels and Robert A. Signorelli Washington Oct. 1976 31 p refs
(NASA-TN-D-8205; E-8673) Avail: NTIS HC $4.00 CSCL 11D

Efforts to improve the impact resistance of B/Al are reviewed and analyzed. Tensile and dynamic modulus tests, thin sheet Charpy and Izod impact tests, and standard full size Charpy impact tests were conducted on 0.20 mm (8 mil) diameter-B/1100 Al matrix composites. Angleplies ranged from unidirectional to + or - 30 deg. The best compromise between reduced longitudinal properties and increased transverse properties was obtained with + or - 15 deg angleply. The pendulum impact strengths of improved B/Al were higher than that of notched titanium and appear to be enough to warrant consideration of B/Cl for application to fan blades in aircraft gas turbine engines.
Author

N76-33294# Brookhaven National Lab., Upton, N.Y. Dept. of Applied Science.
CONCRETE-POLYMER COMPOSITES, A MATERIAL FOR USE IN CORROSIVE ENVIRONMENTS
L. E. Kukacka and M. Steinberg 1976 13 p refs Presented at Intern. Corrosion Forum Devoted Exclusively to the Protection and Performance of Mater., Houston, Tex., 22 Mar. 1976 Sponsored by ERDA
(BNL-20721; Conf-760309-1) Avail: NTIS HC $3.50

Significant improvements in the strength and durability properties of concrete were obtained by the formation of concrete polymer composites. Methods for producing two materials, polymer impregnated concrete and polymer concrete, are discussed and their structural and durability properties summarized. Existing and potential applications for these materials such as for bridge decks, curbstones, pilings, pipe, and storage tanks are reviewed.
ERA

N76-33295# Brookhaven National Lab., Upton, N.Y.
CONCRETE-POLYMER MATERIALS FOR HIGHWAY APPLICATIONS Final Report
L. E. Kukacka, J. Fontana, and M. Steinberg Jun. 1975 55 p refs Sponsored in part by ERDA and DOT
(BNL-50462; FHWA-RD-75-86; TID-4500) Avail: NTIS HC $5.50

Research was done in three general areas: material properties of polymer-impregnated concrete, repair of deteriorated and delaminated bridge decks, and polymer impregnation of new deck surfaces. Structural and durability properties of impregnated normal and structural lightweight concretes were measured. Effects of temperature and cyclic loading were investigated and bond pullout strength of reinforcement was measured. Process variables studied include monomer type, method of polymerization, aggregate type, and air content of the concrete. Compared with the controls, the properties of MMA-impregnated samples were improved by factors ranging from 2.6 to 4.5.
Author (ERA)

N76-33296# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section Plastiques.
TECHNIQUE AND THEORY OF MECHANICAL TEST METHODS OF ARMED PLASTICS [TECHNIQUE ET THEORIE DES METHODES D'ESSAIS MECANIQUES DES PLASTIQUES ARMES]
Fernand Vidouse and Jacques Rondal (Liege Univ.) Nov. 1975 55 p refs In FRENCH Sponsored by Inst. pour l'Encour. de la Rech. Sci. dans l'Ind. et l'Agr.
(CRIF-PL-6) Avail: NTIS HC $4.50

A study is presented of mechanical tests for orthotropic reinforced plastics. The expressions for the generalized Hookes law and constitutive equations of the laminate were developed. Compression and fraction tests; bending and shear tests were performed indicating, for each the theoretical bases, test techniques, data reduction, existing standards, and conclusions. Special torsion tests were performed on plates.
ESA

N76-33297# Aerospace Corp., El Segundo, Calif. Vehicle Engineering Div.
GRAPHITE ABLATION CHEMISTRY NONEQUILIBRIUM EFFECTS Final Report
R. L. Baker 22 Mar. 1976 14 p refs
(Contract F04701-75-C-0076)
(AD-A023898; TR-0076(6550-76)-1; SAMSO-TR-76-10) Avail: NTIS CSCL 20/13

The implication of the assumption of local solid-gas phase equilibrium for subliming carbon species for graphite ablation calculations in an air environment is investigated. The equilibrium assumption is eliminated by considering the Knudsen-Langmuir equation at the interface for each carbon specie. Calculated equilibrium and nonequilibrium results are compared for a very wide range of flight and ground test environments. The nonequilibrium mass addition parameter is always less than the equilibrium value and the non-equilibrium wall temperature is always larger for a given environment. Calculations made to determine the convective heat flux required to reach an incipient melt temperature of 3800 K indicate that the required flux determined from an equilibrium calculation can be too high by as much as 200-300 percent for stagnation enthalpies less than 5000 Btu/lb. Calculations for superorbital reentry conditions show large differences in the mass addition parameter B' when the convective heating rate is low and the external radiation heating level is relatively high. Similar large differences in B' could be simulated in an existing ground test facility if the reported external radiation heating level could be increased. Such an experiment would provide data to test the validity of present convective heating rate blowing corrections in a combined heating environment.
Author (GRA)

N76-33298# Picatinny Arsenal, Dover, N.J.
DIFFUSION AND PERSISTENCE OF SILICONE OIL IN RUBBERS AND LOW DENSITY POLYETHYLENE
C. A. L. Westerdahl Mar. 1976 15 p refs
(DA Proj. 1T1-62105-AH-84)
(AD-A023113; PA-TM-2185) Avail: NTIS CSCL 11/10

Silicone release is used extensively in molding polymers. When it is used on the mold it gradually becomes incorporated into the polymers being molded. If the silicone can migrate it can change the bulk properties of the polymers. Even if it does not migrate and remains primarily at or near the surface, it will change surface properties, such as printability, coatability, and bondability. Therefore, it is of interest to know how much silicone remains within the polymer, whether it migrates and how easy it is to remove. Experiments with a C-14 tagged silicone mold release have given no evidence of its diffusion through polyethylene or the elastomers Buna N, Buna S, butyl, Hypalon, natural, or urethane. Hexane rapidly removed the mold release from rubbers which it did not swell (urethane, Buna N, and Hypalon), Buna S, natural, and butyl rubbers retained a low level of the mold release agent, even after repeated treatment with hexane. This is presumably related to the fact that the latter three rubbers swell in the silicone. Removal of the silicone from polyethylene which

has been molded against a surface coated with the mold release proved difficult. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N76-33299*# California Univ., Los Angeles. School of Engineering and Applied Science.
OXIDATION OF METALS AND ALLOYS IN CONTROLLED ATMOSPHERES USING IN SITU TRANSMISSION ELECTRON MICROSCOPY AND AUGER SPECTROGRAPHY
D. B. Rao, K. Heinemann, and D. L. Douglass Sep. 1976 45 p refs
(Grant NsG-2025)
(NASA-TM-X-74253; UCLA-ENG-7687) Avail: NTIS HC $4.00 CSCL 07D

Single-crystalline thin films of copper were oxidized at an isothermal temperature of 425 C and at an oxygen partial pressure of .005 Torr in situ in a high-resolution electron microscope. The specimens were prepared by epitaxial vapor deposition onto polished 100 and 110 faces of rocksalt and mounted in a hot stage inside an ultra-high-vacuum specimen chamber of the microscope. Large amounts of sulfur, carbon, and oxygen were detected by Auger electron spectroscopy on the surface of the as-received films and were removed in situ by ion-sputter etching immediately prior to the oxidation. The nucleation and growth characteristics of Cu2O on Cu were studied. Results show that neither stacking faults nor dislocations are associated with the Cu2O nucleation sites. The growth of Cu2O nuclei is linear with time. The experimental findings, including results from oxygen dissolution experiments and from repetitive oxidation-reduction-oxidation sequences, fit well into the framework of an oxidation process involving (a) the formation of a surface-charge layer, (b) oxygen saturation in the metal and (c) nucleation, followed by surface diffusion of oxygen and bulk diffusion of copper for lateral and vertical oxide growth, respectively. Author

N76-33300*# Kanner (Leo) Associates, Redwood City, Calif.
STUDIES OF ACTIVE CARBON BLACK USING THE ELECTRON PARAMAGNETIC RESONANCE METHOD
Z. Kecki and L. Lancman Washington NASA Sep. 1976 16 p refs Transl. into ENGLISH from Przemysl Chem. (Warsaw), v. 46, no. 2, 1967 p 94-97
(Contract NASw-2790)
(NASA-TT-F-17207) Avail: NTIS HC $3.50 CSCL 07D

The relationship of free radicals in three types of carbon black and the strengthening properties of carbon black in the process of vulcanizing rubber were considered. The method of electron paramagnetic resonance (EPR) was developed as a measure of free radical concentration in carbon black. Decreased EPR signal intensity was observed in carbon black treated with atomic hydrogen. The decrease confirms the existence of recombination of the free radicals in the carbon black with the atomic hydrogen. The concentration of free radicals in the carbon black is directly correlated with the strength properties of rubbers with carbon black fillers. Author

N76-33301*# Scientific Translation Service, Santa Barbara, Calif.
THE AGING PROCESS OF SUPERSATURATED ZINCATE SOLUTION
V. N. Flerov Washington NASA Sep. 1976 16 p refs Transl. into ENGLISH from O Protsesse Stareniya Peresychchennykn Tsinkatnykn Rastvorov, Zhurnal Fizicheskoy Khimii, (USSR), v 31, no. 1, 1957 p 49-54
(Contract NASw-2791)
(NASA-TT-F-17241) Avail: NTIS HC $3.50 CSCL 07D

The kinetics of aging of supersaturated zincate solution was investigated at various temperatures, alkalinities, and with different additions. These solutions are not truly supersaturated, because neither seeding nor mechanical shock can cause a zincate deposition. Aging shows that some of the Zn is present in a colloidal form, but some unquestionably in the ionic form. The colloidal form results from the peptization of the originally formed Zn(OH)2 by the alkali, or by a discharge of the Zn(++) in an alkali solution. Aging was greatly retarded by the addition of silicates or Li compounds, especially at elevated temperatures which is explained by an intercalation of SiO2 or Li(+) ions into the Zn oxide or hydroxide film which increases the film stability by increasing the thickness of the hydrate layer around the micelles. Author

N76-33302*# Scientific Translation Service, Santa Barbara, Calif.
EXPERIMENTAL INVESTIGATION OF THE BURNING TIME UNDER TWO-STAGE BURNING PROCESS
A. V. Mosin, O. V. Strogonov, V. A. Shchukin, and A. V. Talantov Washington NASA Oct. 1976 8 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Aviats. Tekh. (USSR), no. 1, Jan. 1976 p 67-70
(Contract NASw-2791)
(NASA-TT-F-17279) Avail: NTIS HC $3.50 CSCL 21B

The burning time of a combustion chamber in a wide range of changes in the flow parameters is investigated. Dilution of the fuel mixture by the combustion products at a constant temperature leads to an increase in the burning time. Author

N76-33303# Sandia Labs., Livermore, Calif.
THEORETICAL CALCULATION OF RAMAN SCATTERING CROSS SECTIONS FOR USE IN FLAME ANALYSIS
C. F. Coll and C. F. Melius Feb. 1976 34 p refs
(Contract AT(29-1)-789)
(SAND-76-8204) Avail: NTIS HC $4.00

The laser Raman scattering analysis of combustion flames requires a knowledge of the scattering cross sections for a variety of molecular species. Since cross sections are known for only the most common and most stable of molecules (e.g., N2, O2 and H2), a program to calculate cross sections for other molecules of interest to combustion analysis was initiated. Theoretically determined cross sections for H2, N2, OH, LiH, and O2 are presented. Comparison with the few experimentally determined cross sections indicates that the theoretical approach is a reliable method for determining Raman scattering cross sections for those molecules whose cross sections cannot be readily determined experimentally. Author (ERA)

N76-33304# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
THE REACTION OF BARIUM AND EUROPIUM ATOMS WITH OXIDIZING MOLECULES (O2, N2O) IN MOLECULAR BEAM EQUIPMENT [DIE REAKTION VON BARIUM- UND EUROPIUM-ATOMEN MIT OXYDIERENDEN MOLEKUELEN (O2, N2O) IN EINER UEBERSCHALL-MOLEKULARSTRAHLAPPARATUR]
Reinhard Dirscherl Oct. 1975 163 p refs In GERMAN
(MPI-PAE/Extraterr-113) Avail: NTIS HC $6.75

A thermal metal vapor beam was crossed with a monoenergetic oxidizing jet in order to measure the angular dependence of reaction products. The equipment was used to investigate the following reactions: Ba + O2 (yields) BaO + O, Eu + O2 (yields) EuO + O, Eu + N2O (yields) EuO + N2. Kinematic analysis of the resulting scattering curves was obtained by comparison with the calculated center of mass vectors. The scattering curve for Ba + O2 shows a fine structure with a double peak. The energy dependence of the Eu + O2 reaction was investigated in detail. Comparison with the centroids indicates a shift in the reaction mechanism, going from rebound to complex. The oxidation behavior of europium by H2O takes place according to the stripping mechanism for higher average collisional energies and is similar to that for Eu + O2 for lower energies. ESA

N76-33305# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Reaktionskinetik.
EMISSION SPECTROSCOPICAL INVESTIGATION OF THE SYSTEM F2-H2 IN A SHOCK TUBE
Gerhard Rimpel 30 Apr. 1976 102 p refs In GERMAN; ENGLISH summary Report will also be announced as translation

(DLR-FB-76-27) Avail: NTIS HC $5.50; DFVLR, Cologne DM 38

Mixtures of Ar-F2-H2, containing 0.2% F2 and 0.2% H2, were heated in a shock tube to temperatures of approx. 830 respectively 940 K. The pressures amounted to 4.0 respectively 3.6 bars. The reaction ensuing was observed via the radiation emission of the vibrational excited HF-molecules. The spectral range from 660 to 960 nm was investigated. From these measurements it was possible to determine the population numbers of discrete vibrational levels (v=3,...,9) of the HF-molecule. Chemical kinetic calculations were carried out in order to derive from these measurements information on rate coefficients of certain elementary reactions. By adapting the calculations to the measurements it was found, that VVT-processes between HF molecules do occur much faster at higher vibrational quantum numbers than originally supposed. Conclusions could be made on VT-processes between HF and Ar as well as on the pumping reaction H + F2 yields HF + F. Author (ESA)

N76-33306# British Steel Corp., Sheffield (England). Information Services.

SURVEY OF SPARK SOURCE MASS SPECTROSCOPY AND ITS POSSIBLE APPLICATION TO THE IRON AND STEEL INDUSTRY

A. A. Tunney Feb. 1976 32 p refs

(PB-250900/8; GS/TECH/479/1/75/C) Avail: NTIS HC $4.00 CSCL 11F

The development of spark source mass spectrometry with particular reference to the development of electrical detection systems to supplement and in some cases supersede, photographic detection is traced. The precision and accuracy attainable and some of the associated problems are illustrated. GRA

N76-33307# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.

THE THEORY OF FLAMMABILITY LIMITS. NATURAL CONVECTION Report of Investigations, 1976

Martin Hertzberg Apr. 1976 21 p refs

(PB-252995/6; BM-RI-8127) Avail: NTIS HC $3.50 CSCL 13L

The concept of limit burning velocities is used to formulate a quantitative theory of flammability limits. Competing processes dissipate power from a combustion wave and quench propagation at some characteristically low limit velocity. Complexities are unraveled by creating an idealization which is initially freed from competing processes. The ideal serves as a standard and its burning velocity ideal is a unique function of the initial thermodynamic variables of state. By adding each process individually, it is possible to evaluate their significance, quantitatively, in terms of a limit velocity and to explore the nature of their cooperative interactions. GRA

N76-33308# Exxon Research and Engineering Co., Linden, N.J. Government Research Lab.

HETEROGENEOUS SENSITIZED DECOMPOSITION OF WATER WITH SUNLIGHT Quarterly Progress Report, 1 Oct. - 31 Dec. 1975

Amal K. Ghosh and H. Paul Maruska 30 Sep. 1975 28 p refs

(Grant NSF ERP-75-13901)

(PB-252964/2; Exxon-Gru-2BEA-75; NSF/RA/N-75-238) Avail: NTIS HC $4.00 CSCL 07E

The photoresponse of chromium-doped TiO2 in an electrochemical cell was studied. The UV response did not decrease as a result of doping. Dye sensitized photoconductivity was observed. The visible photoresponse in both cases was lower than the UV response. GRA

N76-33309# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.

ACTIVE MANGANESE DIOXIDE OXIDATION IN ORGANIC CHEMISTRY, PART 1 Final Report

Alexander J. Fatiadi Feb. 1976 43 p refs Repr. from Syn. Rev., Intern. J. of Methods in Syn. Org. Chem., no 2, Feb. 1976 P 65-104

(PB-252391/8) Avail: NTIS HC $4.00 CSCL 07C

The synthetic applications of active manganese dioxide in organic chemistry are discussed. Its selectivity and specificity as an oxidant, dehydrogenation reagent, coupling reagent, and a selective, analytical tool in the structure determination of complex, organic molecules derived from natural products are shown. The mechanism of action and the complexity of the heterogeneous reactions are also discussed. GRA

N76-33310# Environmental Monitoring and Support Lab., Cincinnati, Ohio. Radiochemistry and Nuclear Engineering Branch.

INTERIM RADIOCHEMICAL METHODOLOGY FOR DRINKING WATER

Herman L. Krieger Mar. 1976 81 p refs Revised

(PB-253258/8; EPA-600/4-75-008-Rev) Avail: NTIS HC $4.50 CSCL 07D

A laboratory manual of radiochemical procedures was compiled and edited for use in the analysis of specific radionuclides in drinking water. In addition to gross activity analyses, the procedures for 134/137Cs, 1311, 226/228Ra, 89/90Sr, 3H and 40K were evaluated by replicate testing to determine the method capabilities and minimum detection levels. The sensitivity of these procedures is greater than the present required limits. Reagent preparation and suggested sources for purchasing special equipment are appended. GRA

N76-33311# Aerodyne Research, Inc., Bedford, Mass.

GROWTH OF CARBON PARTICLES Annual Report, 1 Aug. 1974 - 1 Aug. 1975

David M. Mann Oct. 1975 30 p refs

(Contract F44620-74-C-0005; AF Proj. 9711)

(AD-A024479; ARI-RR-72; AFOSR-75-1549TR) Avail: NTIS CSCL 21/2

The specific approach taken in this work was to study particle formation in a cooling jet of carbon vapor diluted by an inert, carrier gas. Vapor was produced by the evaporation of a resistance heated graphite tube. The carbon vapor, mixed with carrier gas, flowed into a light scattering chamber where spectroscopic measurements were used to monitor concentrations of molecular species. Particles were also collected for electron microscopy. An initial reaction leading to particle formation was identified as C2 - C3 yield C5 with a gas kinetic rate. Particulates were found to be spherical, of approximately equal diameter and frequently chained in the manner of hydrocarbon soot.

Author (GRA)

N76-33312# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.

TURBULENCE INTERACTION EFFECTS IN TURBULENT PREMIXED FLAMES

K. N. C. Bray (South Hampton Univ., England) and Paul A. Libby Feb. 1976 84 p refs Prepared by Calif. Univ., San Diego

(Contract N00014-75-C-1143; NR Proj. 098-038; Proj. SQUID)

(AD-A024130; SQUID-TR-UCSD-8-PU) Avail: NTIS CSCL 21/2

The Bray-Moss model for turbulent, premixed combustion is applied to plane, oblique combustion waves. The analysis takes into account the influence of turbulence and inhomogeneity on the effective rate of heat release, and also the competing effects of dilatation and turbulence production due to shear in the turbulence kinetic energy balance. Predictions are made of the flame speed and the structure of the reaction zone in cases where turbulent mixing is rate limiting. Qualitative agreement is found with relevant experimental data. GRA

N76-33313# National Bureau of Standards, Washington, D.C. Electricity Div.

A NEW DETERMINATION OF THE FARADAY BY MEANS OF THE SILVER COULOMETER Final Report

V. E. Bower 1976 7 p refs Repr. from proceedings of 5th Intern. Conf. on Atomic Masses and Fundamental Constants, Paris, Jun. 1975, part 12 p 578-583

(PB-253350/3) Avail: NTIS HC $3.50 CSCL 07D

A determination of the Faraday constant, based on measuring the direct anodic dissolution of a highly purified silver sample into a perchloric acid-silver perchlorate solution, was described. The dissolution is carried out at constant current. The silver sample is weighed before and after the dissolution. During the constant-current electrolysis, some solid silver inevitably falls from

the electrode to the anode compartment floor. Still in the compartment, this residue is filtered, washed, converted to silver nitrate and reduced cathodically at constant potential. The sum of the current-time integrals for both electrolyses divided by the number of moles represented by the mass difference yields the Faraday constant. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N76-33314*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TRANSVERSE TENSILE AND STRESS RUPTURE PROPERTIES OF GAMMA/GAMMA PRIME-DELTA DIRECTIONALLY SOLIDIFIED EUTECTIC
Hugh H. Gray Aug. 1976 23 p refs
(NASA-TM-X-73451; E-8810) Avail: NTIS HC $3.50 CSCL 11F

Tensile and stress rupture properties were determined primarily at 760 C for specimens oriented at various angles (0 deg, 10 deg, 45 deg, and 90 deg) from the solidification direction of bars and/or slabs of the Ni-20Cb-6Cr-2.5A (gamma/gamma prime-delta) eutectic. Threaded-head specimens yielded longer rupture lives with significantly less scatter than did tapered-head specimens. Miniature specimens are suitable for determining traverse tensile and rupture properties of 1.2 centimeter diameter bar stock. The 300 hour rupture stress at 760 C for specimens oriented at 10 deg from the solidification direction was reduced from 740 to 460 MPa, and to 230 MPa for material oriented at either 45 deg or 90 deg. Author

N76-33315*# Kanner (Leo) Associates, Redwood City, Calif.
PRODUCTION AND PROPERTIES OF WHISKER-REINFORCED LIGHT METALS
E. VanResen and K. F. Sahn Washington NASA Aug. 1976 16 p Transl. into ENGLISH from Technical Reports (A73-25401), Oberutsel, West Germany, Deut. Ges. fuer Metallk., 1972 p 272-287 Presented at 2d Composite Mater. Meeting, Konstanz, West Germany, 15-16 Mar. 1972
(Contract NASw-2790)
(NASA-TT-F-17196; A73-25401) Avail: NTIS HC $3.50 CSCL 11F

The whiskers are incorporated by a powder metallurgical technique. First a whisker metal powder mixture with a random whisker orientation is prepared. The mixture is then densified by vacuum hot pressing and finally unidirectionally aligned by extrusion. The effect of extrusion temperature on surface finish and fiber damage is investigated. The tensile strength of the composite was up to three times higher than the strength of the pure matrix. Author

N76-33316# Cornell Univ., Ithaca, N.Y. Dept. of Materials Science and Engineering.
ALLOY DESIGN THROUGH MECHANICAL EQUATION OF STATE
C. Y. Li, F. V. Ellis, and F. H. Huang 1975 42 p refs Presented at Symp. on Alloy Design, Detroit, Oct. 1974 Sponsored by ERDA
(COO-2172-6; Conf-7410156-1) Avail: NTIS HC $4.00

The concept of plastic equation of state and the experimental results which are used to support this approach are introduced. It is shown that considerable savings in mechanical testing are possible in using this approach to establish the constitutive relationships for plastic deformation for a material. Advantages in data correlation and data extrapolation are also described. Examples are given to suggest that the constitutive relationships for plastic deformation obtained may be used as a useful basis for correlating the effects of composition and microstructure changes on mechanical properties and therefore serve as a guide for alloy selection. The savings in mechanical testing suggest also that the approach of plastic equation of state may be adopted for evaluating and assessing the mechanical properties of candidate alloys. NSA

N76-33317# Sandia Labs., Livermore, Calif.
IN SITU OBSERVATIONS OF ION IMPLANTED SURFACES
G. J. Thomas and W. Bauer Feb. 1976 19 p refs Presented at the 2d Intern. Conf. on Surface Effects in Controlled Fusion Devices, San Francisco, 16 Feb. 1976
(Contract AT(29-1)-789)
(SAND-76-8618; Conf-760209-22) Avail: NTIS HC $3.50

A scanning electron microscope facility is described which enables direct observations of sample surfaces during implantation. This technique enables measurements of the growth rates of surface features caused by helium implantation of metals. Results from 300 keV helium implantation of titanium samples indicate that exfoliation or flaking of the sample surface is a distinctly different process from blistering and proceeds at radically different rates. Exfoliation could be significantly reduced by cold working. ERA

N76-33318# Johns Hopkins Univ., Baltimore, Md.
CORRELATION OF MECHANICAL AND METALLURGICAL PARAMETERS WITH THE ACOUSTIC EMISSION DURING TENSILE DEFORMATION OF SEVERAL METALS AND ALLOYS Final Report
W. F. Hartman Dec. 1975 15 p refs
(Contract AT(11-1)-2204)
(COO-2204-14) Avail: NTIS HC $3.50

Acoustic emission was monitored during plastic deformation under dead weight tensile loading of polycrystalline aluminum, brass, copper, and steel. The acoustic emission data, both threshold type and frequency analysis type, were correlated with yield strength, stored elastic energy, strain hardening parameters, loading histories, diffusion processes, slip band motion and mosaic cell size. Major results are presented and the principal experimental techniques are summarized. Author (ERA)

N76-33319# Bendix Corp., Kansas City, Mo.
QUANTITATIVE AUGER ELECTRON ANALYSIS OF GOLD-COPPER ALLOYS
R. L. Hanlin and D. L. Stoltz Jan. 1976 22 p refs Revised
(Contract AT(29-1)-613)
(BDX-613-1466-Rev) Avail: NTIS HC $3.50

Quantitative Auger electron analysis was established for gold-7 to 80 atomic percent copper alloys. The importance of sample preparation, operating conditions, and methods of data analysis are discussed. Auger determined gold-copper contents are compared to values obtained by wet chemical analysis and electron microprobe analysis. A systematic procedure is described that correlates the relative errors in gold-copper ratios to each of the experimental variables. This procedure appears promising for other gold base alloys. Author (ERA)

N76-33320# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Abteilung Korrosion.
INVESTIGATION OF THE STRESS CORROSION CRACKING SUSCEPTIBILITY OF THE ALLOY AlZnMgCu 1.5 WITH REGARD TO ELECTROCHEMICAL AND METALLURGICAL ASPECTS
Guenter Mierke 7 May 1976 98 p refs In GERMAN; ENGLISH summary Report will also be announced as translation
(DLR-FB-76-29) Avail: NTIS HC $5.00; DFVLR, Cologne DM 36.50

Investigations of the stress-corrosion cracking susceptibility were made by the method of constant strain rate. Stress-elongation curves were taken in the electrolyte. Parameters were ultimate tensile stress, uniform elongation, relative fracture energy and reduction of area of fracture. Electrochemical and metallurgical factors were varied, for example constant electrode potential, defined surface layers, alloy composition, test direction, and additions to the electrolyte. Author (ESA)

N76-33321# Pratt and Whitney Aircraft, Middletown, Conn. Materials Engineering and Research Lab.
DEVELOPMENT, GROWTH AND ADHESION OF Al2O3 ON PLATINUM-ALUMINUM ALLOYS Final Report, 1 Apr. 1973 - 31 Dec. 1975
Frederick S. Pettit and Edward J. Felten 30 Jan. 1976 10 p refs

(Contract DAHC04-73-C-0021)
(AD-A022581; ARO-11209.1-MC) Avail: NTIS CSCL 11/6

The development, growth and adhesion of alpha-Al2O3 scales on platinum-aluminum alloys containing between 0.5 and 10 weight percent aluminum and on Ni-Al and Ni-Cr-Al alloys containing platinum have been studied at temperatures in the interval between 1000 and 1450C. The morphologies and microstructures of the alpha-Al2O3 scales were found to be influenced by the temperature, oxygen pressure and the microstructures of the alloys. The oxidation rates of the alloys appeared to be controlled by transport of oxygen along grain boundaries in the alpha-Al2O3 scales. The Al2O3 scales were very adherent to the platinum-aluminum alloys containing up to 6 weight percent aluminum even after extensive periods of cyclic oxidation. The alpha-Al2O3 scale formed on the alloy containing 10 weight percent aluminum was less adherent during cyclic oxidation. Platinum also improved the adhesion of Al2O3 on the Ni-Al and Ni-Cr-Al alloys. GRA

N76-33322# Washington Univ., Seattle. Dept. of Mechanical Engineering.
DYNAMIC FINITE ELEMENT AND DYNAMIC PHOTOELASTIC ANALYSES OF TWO FRACTURING HOMALITE-100 PLATES
A. S. Kobayashi, A. F. Emery, and S. Mall Dec. 1975 27 p refs
(Contract N00014-76-C-0060; NR Proj. 064-478)
(AD-A023299; TR-23) Avail: NTIS CSCL 11/6

A dynamic finite element code, HONDO, was used to analyze two single-edge-notched fracturing Homalite-100 plates which had been previously studied by dynamic photoelasticity. A single-edge crack in the finite element model was advanced in incremental jumps such that the time averaged crack velocity matched the measured crack velocity in the Homalite-100 plate. Dynamic energy release rates were computed for a constant velocity crack and a crack which arrested after a somewhat constant deceleration. These results were compared with the corresponding dynamic energy release rates, which were computed from the dynamic stress intensity factors determined by dynamic photoelasticity, and by static strain energy release rates. Despite the crude modeling of the running crack, the coarseness of the finite element grid breakdown and the differences in the modeled and actual grip conditions, the computed and measured dynamic energy release rates, except for occasional large differences, generally agreed within 10 percent of each other. GRA

N76-33323# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
THE SINGLE CRYSTAL SYNTHESIS AND SOME PROPERTIES OF ALUMINUM NITRIDE Physical Sciences Research Papers
Cortland O. Dugger Aug. 1975 68 p refs
(AF Proj. 5620)
(AD-A023630; AFCRL-TR-75-0486; AFCRL-PSRP-656) Avail: NTIS CSCL 20/2

This final report, which covers the period from March 1972 to 30 June 1975, discusses some conditions for the synthesis of aluminum nitride (AlN) single crystals from solution. The solvent systems used are unique and novel. The average sized, water-white, bipyramidal AlN single crystals reproducibly grown from solution only were 1.1 mm long X 0.3 mm wide. The average sized, AlN single crystals grown from a combined solution-vapor reaction technique were 4mm long X 3 mm wide X 2mm thick. The in-house quantitative evaluation of the crystals was restricted to Laue patterns and emission spectrometry only. In Appendices A, B, C, and D, general discussions of solution growth, other AlN growth methods, some properties of AlN, and a very brief discussion of the newly emerging surface acoustic wave (SAW) device technology and why the use of AlN is considered a good electro-acoustic material in SAW devices are presented. Author (GRA)

N76-33324# British Steel Corp., Sheffield (England). Information Services.
THE EFFECT OF STRESS-RELIEF ON THE MECHANICAL PROPERTIES OF BS 1501-271 GRADE MATERIAL
D. Yates Feb. 1976 15 p
(PB-250901/6; GS/PROD/687/1/75/C) Avail: NTIS HC $3.50 CSCL 11F

Two commercial samples and two experimental lean samples of BS 1501-271 steel were tested after both the conventional normalizing and tempering treatment, and after the additional stress relieving cycle. There was a slight deterioration in both strength and impact values after the stress relieving treatment, but this was no more severe in the lean steels than in the commercial steels. Provided the steels have a sufficiently high CEV to satisfy the mechanical property requirements, the properties obtainable after the additional stress relieving treatment should satisfy the proposed requirements in the draft revision of BS 1501-part 2. GRA

N76-33325# Bureau of Mines, Rolla, Mo. Metallurgy Research Center.
IMPROVED PROPERTIES OF LEAD-ANTIMONY ALLOYS BY THERMOMECHANICAL TREATMENTS Research Report, FY 1975
M. M. Tilman, R. L. Crosby, and L. A. Neumeier Dec. 1975 33 p refs
(PB-250653/3; BM-RI-8094) Avail: NTIS HC $4.00 CSCL 11F

The Bureau of Mines developed a rolling method that improves creep resistance and yield strengths of lead alloys containing up to 5 wt-pct Sb. The 0.69-inch-thick slab-cast alloys were breakdown-rolled to 0.226 inch and finish-rolled to 0.063 inch at 5- or 20-pct reduction per pass. Rolling was at room temperature to simulate conventional cold rolling, and at 75, 125, and 175 C. Alternative methods evaluated consisted of: (1) a single cold final pass followed by annealing and (2) a single hot final pass. Additional processing methods involving precipitation strengthening were included for comparison. Hot rolling at 125 and 175 C with multiple light passes vastly improves creep resistance and raises yield strengths. GRA

N76-33326# Southwest Research Inst., San Antonio, Tex.
A STUDY OF STRESS CORROSION PHENOMENA RESULTING FROM TRANSPORTATION OF ANHYDROUS AMMONIA IN QUENCHED-AND-TEMPERED STEEL CARGO TANKS Final Report
Fred F. Lyle, Jr. Feb. 1976 100 p refs
(Contract DOT-FH-11-8568)
(PB-250483/5; SwRI-01-4101-001; DOT-FH-BMCS-11-8568) Avail: NTIS HC $5.00 CSCL 11F

The primary causative agent of stress corrosion cracking (SCC) of quenched and tempered steels exposed to liquid ammonia is oxygen contamination. Under certain conditions carbon dioxide and water may also act as causative agents. Water in concentrations of 2000 ppm or greater inhibits SCC. Methane and nitrogen also exhibit inhibitory effects. As produced liquid ammonia contains sufficient oxygen to cause cracking in many cases. The slow strain rate method is an accelerated test which produces stress corrosion fractures with characteristics identical to those of service failures. GRA

N76-33327# Battelle Columbus Labs., Ohio.
CRITICAL SURVEY OF DATA SOURCES: CORROSION OF METALS Final Report
Ronald R. Diegle and Walter K. Boyd Jan. 1976 41 p refs
(PB-250844/8; NBS-SP-396-3; LC-75-34273) Avail: NTIS HC $4.00 CSCL 11F

A directory of authoritative sources of information on corrosion of metals is provided. It assesses the scope, assets, and deficiencies of about thirty eight of the most important sources. These include handbooks and technical compilations, information centers, technical societies, and trade associations and institutes. The directory is indexed by materials and types of corrosion. GRA

N76-33328# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
MEASUREMENTS OF STRESS CORROSION CRACKS IN ALUMINUM ALLOY DCB SPECIMENS USING AN ULTRASONIC PULSE-ECHO TECHNIQUE Final Technical Report, Jan. - Jul. 1975
Peter J. Blau and Walter M. Griffith Jan. 1976 42 p refs
(AF Proj. 7351)

(AD-A023185; AFML-TR-75-200) Avail: NTIS CSCL 01/3

This program evaluated a non-destructive ultrasonic method for monitoring crack growth rate. Alumimum alloy test specimens were used to calibrate the equipment and to assess the measurement accuracy and reproducibility. Together, the optical and ultrasonic techniques could lead to a more accurate assessment of stress corrosion crack growth in aerospace alloys through obtaining a truer picture of interior crack front shapes. GRA

N76-33329*# National Bureau of Standards, Washington, D.C. Inst. for Applied Technology.

THERMAL CONDUCTIVITY AND ELECTRICAL RESISTIVITY OF SIX COPPER-BASE ALLOYS Final Report

M. C. I. Siu, W. L. Carroll, and T. W. Watson Mar. 1976 22 p refs Sponsored in part by NASA

(NASA-CR-148752; PB-251211/9; NBSIR-76-1003) Avail: NTIS CSCL 11F

Measured values of the thermal conductivity and electrical resistivity of oxygen-free copper and six copper-base alloys are presented. With one exception, the measured lambda values of these materials and the lambda values predicted by the Smith-Palmer equation using measured rho values agree to within about 3 percent. The exceptional case is believed to be due to erroneous rho data, and not due to limits of validity of the Smith-Palmer equation. GRA

N76-33330# National Materials Advisory Board, Washington, D.C. Commission on Sociotechnical Systems.

TRENDS IN USAGE OF MAGNESIUM. REPORT OF THE PANEL ON TRENDS IN USAGE OF MAGNESIUM OF THE COMMITTEE ON TECHNICAL ASPECTS OF CRITICAL AND STRATEGIC MATERIALS

1975 111 p refs

(Contract GS-00-DS-(P)-94008)

(PB-254189/4; NMAB-322) Avail: NTIS HC $5.50 CSCL 11F

Three major questions were addressed: (1) how available is magnesium if wide-scale substitution is required, (2) how well can magnesium be converted to useful articles as a substitute, and (3) how well will an article made of magnesium perform when compared with the same article made of another material. Magnesium is a relatively new member of the metals community and its low density orients it toward aluminum substitution. Concentration of the study was on comparisons of magnesium with aluminum. The Panel examined the present magnesium industry, its past history, and its probable future. Production costs for aluminum and magnesium were reviewed to determine whether the costs of producing either could be altered substantially. The economics of various fabrication processes for magnesium were examined. GRA

N76-33331# Tennessee Univ., Knoxville. Dept. of Mechanical and Aerospace Engineering.

AN EXPERIMENTAL AND ANALYTICAL INVESTIGATION OF A RADIAL FACE SEAL Interim Report

Timothy W. Swafford Jan. 1976 161 p refs

(Contract N00014-75-C-0390)

(AD-A024463; ME-76-T57-22) Avail: NTIS CSCL 11/1

A complete description concerning the interface region of a parallel radial face seal has been conducted both experimentally and analytically. Analytical predictions stem from a FORTRAN IV computer program designed such that density and viscosity variation with temperature can be simulated. The equations of motion were solved on an incremental basis to yield a 'closed form, finite difference' solution. For comparison purposes, predictions assuming non-temperature dependent fluid properties are also given. Experimentally determined parameters include vertical load, torque, interface pressures, and temperatures, while interface clearance, supply pressure, and rotational speed were externally set parameters affecting seal performance. Unlike most other investigators, the test seal was rigidly mounted and both surfaces were constructed of stainless steel. Numerically predicted temperature dependent and non-temperature dependent fluid property pressure profiles deviate substantially when fluid temperature rise becomes significant; thus decreasing the load carrying capacity of the seal. Predictions involving a temperature-dependent fluid indicate higher leakage rates and lower torque values when compared to predictions assuming a non-temperature dependent fluid. Experimental testing was carried out under several sealing conditions. GRA

N76-33332# Advisory Group for Aerospace Research and Development, Paris (France).

THE THEORY, SIGNIFICANCE AND PREVENTION OF CORROSION IN AIRCRAFT

Sep. 1976 158 p refs Presented as a lecture series, Wright-Patterson AFB, Ohio, 6-7 Oct. 1976; Delft, Netherlands, 11-12 Oct. 1976; Lisbon, 14-15 Oct. 1976

(AGARD-LS-84) Avail: NTIS HC $6.75

The significance, implications and economics of the various types of corrosion in aircraft were discussed, as well as the threats and preventive measures for the product life cycle: design, material selection, construction, maintenance and repair, inspection and test. The stress is placed on the need for greater application of known preventive methods, greater visibility of the problem, expanded engineering education, and better practical transfer of knowledge and technology. For individual titles, see N76-33333 through N76-33340.

N76-33333 Promisel (N. E.), Silver Spring, Md.

INTRODUCTION: A SURVEY OF THE PROBLEM

N. E. Promisel *In* AGARD The Theory, Significance and Prevent. of Corrosion in Aircraft Sep. 1976 5 p (For availability see N76-33332 24-26)

The overall situation and perspective of the corrosion problems in aircraft was reviewed. A striking paradox is that, despite extensive research and knowledge in the field of corrosion and practical measures to combat it, aircraft corrosion damage is still being experienced that annually is costing many millions of dollars, as well as indirect penalties such as aborted missions, decreased aircraft usage factor, and even, occassionally, safety hazards to aircraft and personnel. It appears that there does not exist an adequate transfer of technology between scientists, engineers, designers, and users. The cost of corrosion should be determined by looking at a complete life cycle of a total system. Aircraft are subject to practically every type of corrosion: pitting, intergranular, fatigue, stress-corrosion cracking, crevice, bacterial, embrittlement, fretting, galvanic, etc. Easy access for in situ inspection should be a prime factor in aircraft design. Y.J.A.

N76-33334 Technische Hogeschool, Delft (Netherlands).

CORROSION THEORY AND PRACTICE

W. A. Schultze *In* AGARD The Theory, Significance and Prevent. of Corrosion in Aircraft Sep. 1976 19 p refs (For availability see N76-33332 24-26)

A number of basic concepts and definitions related to corrosion were first reviewed, such as: metallic corrosion, electrolytic corrosion, electrochemical reaction, electrode reaction. The thermodynamical concept of the equilibrium electrode potential was then introduced and applied to the various types of electrode reactions that could occur between metal and environment. The kinetic concepts of polarization and overpotential are treated and applied to the study of the rate of the reactions that are involved in corrosion processes. This is followed by a discussion of the mixed potential theory of electrochemical corrosion for a homogeneous metal. Some aspects of the types of corrosion that can occur when a metal consists of different phases, a combination of different metals is used, or a metal structure is exposed to an inhomogeneous environment or to stresses, are presented; these include pitting corrosion, crevice corrosion, intergranular corrosion, stress corrosion cracking, or corrosion fatigue. Y.J.A.

N76-33335 Ohio State Univ., Columbus. Dept. of Metallurgical Engineering.

ECONOMICS OF CORROSION

R. W. Staehle *In* AGARD The Theory, Significance and Prevent. of Corrosion in Aircraft Sep. 1976 3 p (For availability see N76-33332 24-26)

The uncertainties related to the problems of defining the real costs of corrosion to military aircraft due to the complete lack of manipulable information were described. Various informed but informal estimates suggest that the costs directly associated with corrosion, including repair and inspection, are at least 25%

of the maintenance costs, which are of the order of $1.5-2.0 billion per year. Some general considerations which should serve as a reasonable basis for improving the understanding of not only corrosion economics but the general problem of maintenance economics are outlined Author

N76-33336 Naval Aircraft Materials Lab., Fleetlands (England).
CORROSION IN AIRFRAMES, POWER PLANTS AND ASSOCIATED AIRCRAFT EQUIPMENT
E. J. Hammersley *In* AGARD The Theory, Significance and Prevent. of Corrosion in Aircraft Sep. 1976 16 p refs (For availability see N76-33332 24-26)

A review of corrosion problems in airframes, power plants, and aircraft equipment primarily found on naval and other aircraft operating in marine environments was presented. The following factors affecting the problem were first discussed: exposure (special nature of marine environment), initial standards (choice of materials, protection and inspection techniques, maintenance), feedback of information (between engineers, designers, and users), economics (original cost and operating cost), awareness of the problem (training of users). Specific corrosion problems encountered in the following aircraft components were then described: airframe structures (aluminum, magnesium, ferrous, titanium alloys; paint protective systems, geometric considerations, and the use of temporary or supplementary preservatives), engines, and aircraft equipment. Some comments on corrosion monitoring were also given. Y.J.A.

N76-33337 Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Aircraft Div.
CORROSION PREVENTION TECHNIQUES, MAINTENANCE AND REPAIR
Karl O. Sippel *In* AGARD The Theory, Significance and Prevent. of Corrosion in Aircraft Sep. 1976 15 p refs (For availability see N76-33332 24-26)

Possibilities which exist to increase the corrosion resistance of aircraft structures, mainly involving aluminum alloys, were described. Material selection and its treatment, application of suitable surface protections, and appropriate procedures during assembly were considered. Other materials, such as titanium and steel are also taken into consideration. Special attention is drawn to those problems which arise during assembly and result from incompatibility of protective coatings with structural materials or fasteners. Furthermore, a short description of a procedure used to determine inspection intervals by taking corrosive influence into account was given. As corrosion-preventive coatings on surfaces and fasteners are easily damaged, simple and inexpensive repair methods obtain great significance in practice. Therefore, methods in common practice in today's aircraft maintenance to repair corrosion-preventive coatings are described. Author

N76-33338 Societe Nationale Industrielle Aerospatiale, Suresnes (France). Lab. Central.
CORROSION: STUDY AND DETECTION
M. Brunin, G. Sertour, and C. Bezaud *In* AGARD The Theory, Significance and Prevent. of Corrosion in Aircraft Sep. 1976 16 p refs (For availability see N76-33332 24-26)

Two lines of approach to the study of corrosion phenomena are examined in parallel: corrosion reproduction and accelerated tests, and determination of corrosion rates. (1) Acclerated Corrosion Tests. Various types of test have been developed for the reproduction and acceleration of natural phenomena, such as salt spray, continuous and alternating immersion, and climatic cycle tests, together with exposure to marine and tropical environmental conditions. The development and utilization of these tests by a series of examples is demonstrated. (2) Measurement of Corrosion Rates. The rate of corrosion is obviously a valuable tool for forecasting damage resulting from this phenomenon, and its measurement is therefore amply justified. Methods used in this context, in particular the use of potentiostatic curves and measurement of impedance at low frequencies, are described. The application of these methods to the testing of anodizing is illustrated. In the context of stress corrosion cracking, the study of the kinetics of crack propagation likewise represents a powerful method of investigation and forecasting. Author

N76-33339 Ohio State Univ., Columbus. Dept. of Metallurgical Engineering.
DESIGNING FOR CORROSION PREVENTION
R. W. Staehle *In* AGARD The Theory, Significance and Prevent. of Corrosion in Aircraft Sep. 1976 26 p refs (For availability see N76-33332 24-26)

Approaches that may be used in aircraft design to prevent or minimize, in general, corrosion were discussed. These include: (1) simple preventive ideas, such as avoiding chlorides, high surface stresses, hydrogen in metals, etc., (2) point of view that aircraft must be designed on the basis of cyclic loading or fatigue, (3) the life cycle costs (capital and maintenance) must be kept as low as possible without compromising safety, reliability, or availability, (4) compromise must be made between the use of high strength, light weight, heterogeneous material systems and the chemical or mechanical instability of all engineering materials, with resulting problems of accelerated corrosion due to intimate juxtaposition. Applications were made to the B-1 program and to various alloys. Y.J.A.

N76-33340 Advisory Group for Aerospace Research and Development, Paris (France).
PREVENTION AND COMBAT OF CORROSION IN AIRCRAFT STRUCTURES, BIBLIOGRAPHY
In its The Theory, Significance and Prevent. of Corrosion in Aircraft Sep. 1976 34 p refs (For availability see N76-33332 24-26)

A bibliography with abstracts dealing with aircraft corrosion was presented. The following areas were covered: high temperature corrosion, erosion and cavitation, manufacturing processes, non-destructive testing and inspection, failure analysis, fracture, fatigue, and stress corrosion cracking, wear, general and galvanic corrosion, exfoliation, localized corrosion, coatings, surface finish, and plating, power generation, fuels, and combustion, materials selection, testing, and evaluation. Author

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N76-33341# Rockwell International Corp., Anaheim, Calif. Missile Systems Div.
RESISTIVITY AND DEEP IMPURITY LEVELS IN SILICON AT 300 DEGREES K
N. Sclar 30 Sep. 1976 12 p refs
(X76-1090/034A) Avail: NTIS HC $3.50

Families of curves of the resistivity at 300 K for n and p type silicon doped with deep activation energy impurties are presented as a function of impurity concentration. These curves are based on analyses of Irvin's curves, applicable to the shallow activation energy impurities, and on the properties of the deeper activation energy impurities. Author

N76-33342*# Kanner (Leo) Associates, Redwood City, Calif.
LONG-TERM CHARACTERISTICS OF GLASS FIBER REINFORCED PLASTICS/GLASS FIBER REINFORCED UNSATURATED POLYESTERS IN THE CASE OF CYCLIC LOADING
W. Brockmann and E. Roeder Washington NASA Sep. 1976 28 p refs Transl. into ENGLISH of "Langzeitverhalten von GFK (GFUP) bei Zyklischer Beanspruchung" Frankfurt am Main, Arbeitsgemeinschaft Verstarkte Kunstoffe, 1974 p 10-1 to 10-8 Presented at Arbeitsgemeinschaft Verstarkte Kumstoffe, Public Ann. Meeting, 12th, Freudenstadt, West Germany, 1-4 Oct. 1974
(Contract NASw-2790)
(NASA-TT-F-17197) Avail: NTIS HC $4.00 CSCL 11I

The effect of tensile stresses of varying magnitude on glass reinforced polyesters is investigated. It is found that the materials can withstand 10 million stress cycles even in cases in which the first damaging effects in the laminate were already observed after a few cycles. The strength characteristics of laminate materials consisting of several laminate layers depend on the order and sequence of the laminate layers in the laminate compound structure. Other factors which determine the material strength are the resin, the reinforcing agent, and details of processing. Different damage progression characteristics in the

case of short and long cycles are found with the aid of acoustic emission analysis. Author

N76-33343*# Scientific Translation Service, Santa Barbara, Calif.
CONTRIBUTION TO THE STUDY OF THE ELECTRONIC PROPERTIES OF GRAPHITIC CARBON Ph.D. Thesis
P. Delhaes Washington NASA Oct. 1976 166 p refs Transl. into ENGLISH of "Contribution a l'Etude des Proprietes Electroniques de Carbones Graphitiques" Bordeaux Univ., 1965 p 1-145
(Contract NASw-2791)
(NASA-TT-F-17245) Avail: NTIS HC $6.75 CSCL 20L

A study was made of the variation of the paramagnetism of carbon during graphitation. The thermal variations of the resonance signals were determined, taking into account the experimental data. A phenomenological model is used which represents the density of the electron energy levels. Author

N76-33344*# Kanner (Leo) Associates, Redwood City, Calif.
PLASMA-SPRAYED ELECTRICALLY INSULATING CERAMIC COATINGS
K. Kirner Washington NASA Sep. 1976 17 p refs Transl. into ENGLISH from Bosch Technische Berichte, v. 2, no. 5, Nov. 1968 p 220-226
(Contract NASw-2790)
(NASA-TT-F-17288) Avail: NTIS HC $3.50 CSCL 11B

The technique of plasma spraying makes possible the deposition of electrically insulating ceramic coatings on metals, graphite and other conductors. The oxide ceramic materials usable for this purpose are described and the range of possible applications is illustrated by a number of examples. The chief advantages of the coatings are: (1) electrical insulation even at high temperatures; (2) electrical insulation combined with good thermal conductivity; (3) independence of the shape of the body to be insulated, and (4) possibility of local insulation. Author

N76-33345# Naval Surface Weapons Center, Dahlgren, Va.
SINGLE PARTICLE IMPACT ON ATJ-S GRAPHITE Interim Report
Ralph E. Phinney, Robert A. Leverance, and Socrates A. Longas 22 Dec. 1975 44 p refs
(AD-A023617; NSWC/WOL/TR-75-199) Avail: NTIS CSCL 11/2

Craters were obtained in a typical brittle high-temperature graphitic material by the impact of water, glass, nylon, steel, and lead spheres in the White Oak Laboratory Ballistics Range Facility. The crater depth and volume are tabulated for the various impacting particles at various velocities up to 10K ft/sec. These results are discussed and interpreted in terms of various theoretical models. Author (GRA)

N76-33346# RCA Labs., Princeton, N.J.
BASIC ADHESION MECHANISMS IN THICK AND THIN FILMS Final Report, 1 Jan. - 31 Dec. 1975
Thomas T. Hitch and Kenneth R. Bube 30 Jan. 1976 144 p refs
(Contract N00019-75-C-0145)
(AD-A023091; PRRL-76-CR-7) Avail: NTIS CSCL 11/3

A study of adhesion mechanism in silver, copper and gold conductors and thick film conductor ink constituents is presented. Data on the sintering rates of the characterized gold, silver and copper powders are compared with similar data taken after adding a typical glass frit to the metal. Glass wetting rates were measured on substrates of gold, silver, copper and alumina, and the effects of adding copper oxide to the glass were noted. Layered-structure conductors were produced by screening and firing the glass phase layer before the metal phase layer. In other experiments a metal foil was laminated to the glass layer. In the case of copper, adhesion strength improved when the metallization was fired in a slightly oxidizing atmosphere. These data are discussed in terms of the theoretical behavior of ink materials, and their properties are compared with those of 13 silver and 4 copper commercial thick-film conductors. Chemical and physical analytical data are presented for the commercial inks. In both the 'model ink' and the commercial ink studies, the chemical activity of the metal on which the inks were based was found to have a significant effect on ink properties. Adhesion was generally significantly higher for silver-based inks than for gold-based inks despite the fact that a smaller volume fraction of binder was found in silver than in gold inks. GRA

N76-33347# General Electric Co., Schenectady, N.Y.
INVESTIGATION OF CERAMICS FOR HIGH TEMPERATURE TURBINE COMPONENTS Final Report, 18 Oct. 1974 - 17 Oct. 1975
Svante Prochazka, Curtis A. Johnson, and Robert A. Giddings Dec. 1975 115 p refs
(Contract N62269-75-C-0122)
(AD-A022901; SRD-75-126; NADC-76004-30) Avail: NTIS CSCL 11/2

The sintering kinetics of boron-doped SiC were studied in a high temperature dilatometer and discussed in terms of density and densification rate vs. temperature, time, sintering atmosphere, green density and initial crystallite size. A nitrogen furnace atmosphere was found to retard sintering and halt the Beta to alpha transformation. The fracture strength of sintered SiC was characterized in three-point bending as a function of powder processing technique, sintering atmosphere, density, and machining damage. The optimum powder processing included wet milling, screening (8 micrometers), spray freezing and freeze drying. Surface damage induced during machining could be 'repaired' by an appropriate thermal treatment. The high temperature strength was measured in both bending and tension (theta tensile specimens) at 1600 C revealing exceptionally good resistance to subcritical crack growth. The response of sintered SiC to thermally induced stresses was tested by the 'Simulated Gas Turbine Environment Test' of NASA and the 'Glenny Thermal Fatigue Test.' Thermal stresses and probabilities of failure for the latter were computed by finite element analysis. Author (GRA)

N76-33348# Southwest Research Inst., San Antonio, Tex.
COMPRESSIVE STRENGTH OF POLYCRYSTALLINE ALUMINA Interim Report, 4 Apr. 1975 - 31 Mar. 1976
James Lankford, Jr. 30 Apr. 1976 24 p refs
(Contract N00014-75-C-0668; NR Proj. 032-553; SwRI Proj. 02-4231)
(AD-A024145) Avail: NTIS CSCL 11/2

The compressive strength of polycrystalline alumina at 23C is found to be strain rate and temperature sensitive, but insensitive to environment. Scanning electron microscopy of specimens loaded to near failure indicates the basis of the thermally-activated process which controls failure to be localized plasticity in the form of twinning and, possibly, slip. The interaction of these deformation bands with grain boundaries causes the initiation of microcracks. Higher stresses produce still more twin/slip nucleated microcracks, which finally coalesce at failure. Twinning occurs at stresses below 50% of the failure strength and may play a role in crack nucleation during indentation and impact loading. It is suggested that twinning may also be related to the tensile failure of alumina. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N76-33349*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Houston Astronautics Div.
SHUTTLE ECLSS AMMONIA DELIVERY CAPABILITY
17 Mar. 1976 6 p ref
(Contract NAS9-13970)
(NASA-CR-151012; DN-1.4-7-195) Avail: NTIS HC $3.50 CSCL 21D

The possible effects of excessive requirements on ammonia flow rates required for entry cooling, due to extreme temperatures, on mission plans for the space shuttles, were investigated. An analysis of worst case conditions was performed, and indicates that adequate flow rates are available. No mission impact is therefore anticipated. Author

N76-33350# Institut fuer Chemie der Treib- und Explosivstoffe, Pfinztal (West Germany).
APPLICATION OF THE VIRIAL EQUATION TO DETERMINE INTERIOR BALLISTIC PARAMETERS [ANWENDUNG DER VIRIALGLEICHUNG ZUR ERMITTLUNG INNENBALLISTISCHER GROESSEN]
H. Bathelt and F. Volk 13 Oct. 1975 39 p refs In GERMAN
(ICT-2/75) Avail: NTIS HC $4.00

Performance calculations were made for a gun propellant with an explosion heat of 970 cal/g using the ideal gas and the Virial equation. The Virial equation was used as equation of state for real gases. It is shown that the second and third Virial coefficient can be calculated for gases and gas mixtures using potential functions. A FORTRAN program was used for computation. ESA

N76-33351# Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE SENSITIVITY OF DOUBLE BASE PROPELLANT BURNING RATE TO INITIAL TEMPERATURE
Richard C. Strittmater, Emma M. Wineholt, and Hughes E. Holmes Feb. 1976 40 p refs
(DA Proj. 1T1-61102-AH-53)
(AD-A022200; BRL-MR-2593) Avail: NTIS CSCL 21/9

Burning rate, surface temperature, and maximum fizz zone temperature were measured in a combustion chamber that was constructed to optimize photography of the burning surface and permit adjustment of initial temperature of the propellant sample over a wide range. The chamber was constructed to provide inert atmospheres from 0.01 atmosphere to 10 atmospheres. Data are given for X-14, M2, M7, amd M13 double base propellants. Author (GRA)

N76-33352# National Bureau of Standards, Washington, D.C.
HYDROCARBONS FOR FUEL: 75 YEARS OF MATERIALS RESEARCH AT NBS Final Report
George T. Armstrong May 1976 25 p refs
(PB-253665/4; NBS-SP-434; LC-75-619428) Avail: NTIS HC $3.50 CSCL 21D

In this historical review the National Bureau of Standards work on hydrocarbons is discussed in terms of the three major classes of natural hydrocarbonaceous fuels: natural gas, petroleum, and coal. The work done on the measurement of properties of the pure components included measurement of the values of the properties themselves and development of practical and accurate measurement procedures and instruments. In addition, combustion energies, densities, viscosities, vapor pressures, refractive indices, elemental compositions and other parameters were determined for complex fuel mixtures and correlated to find methods of estimating properties. Extensive standard reference data tables were compiled and a number of standard reference materials were developed. GRA

N76-33353# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
US ARMY HELICOPTER MODIFIED FUEL DEVELOPMENT PROGRAM: REVIEW OF EMULSIFIED AND GELLED FUEL STUDIES Final Report
W. D. Weatherford, Jr. and F. W. Schaekel Jun. 1975 84 p refs
(Contracts DAAD05-70-C-0250; DAAK02-73-C-0221)
(AD-A023848; AFLRL-69) Avail: NTIS CSCL 21/2

The report describes the general physical characteristics of the pumpable, high-internal-phase-ratio emulsified fuels developed as part of this research program and explains apparently anomalous flow behavior in terms of rheological effects identified during the program. The studies described in this report established that the crash-fire-safety properties of volatile fuels such as JP-4 could not be significantly improved by emulsification or gellation with presently developed additives. Experimental studies demonstrated that low-volatility JP-8 and Jet A-1 fuels possess fire safety advantages over JP-4 fuel; however, in fuel misting situations, liquid JP-8 appears to be no safer than liquid JP-4. On the other hand, high-internal-phase-ratio rigid emulsions of JP-8 retain their fire-safety advantage over liquid JP-4 fuel in mist-forming situations. Hence, emphasis in the research program conducted after 1969 was placed on the use of JP-8, JP-5, and Jet A-1 fuels. Flammability experiments demonstrated that the low-consistency gelled Jet A-1 fuel developed by FAA would not produce mist fires under the conditions of the tests employed. Its compatibility with UH-ID/H fuel system components was better than that of emulsions, but it was observed that this fuel thickened substantially upon exposure to a quiescent water layer, apparently because of selective extraction of gel-thinning ingredients by the water phase. GRA

N76-33354# Energy Research and Development Administration, Bartlesville, Okla. Energy Research Center.
EFFECT OF GASOLINE ADDITIVES ON GASEOUS EMISSION, PART 2 Final Report, 1974 - 1975
R. W. Hurn, F. W. Cox, and J. R. Allsup Feb. 1976 63 p refs
(PB-254238/9; EPA-600/2-76-026-Pt-2) Avail: NTIS HC $4.50 CSCL 21D

The effects of nitrogen-containing fuel additives in gasoline on regulated and nonregulated automotive emissions were studied. Methodology was developed to measure possible nitrogen-containing compounds and was used to analyze the emissions from a variety of cars without catalysts. Of the nonregulated nitrogen compounds analyzed, ammonia, amines, nitriles, nitrosoamines, and aryl nitro compounds were not detected; HCN, cyanogen, and alkyl nitro compounds were measured. Emission data are included from a rotary engine (Mazda), an air-cooled engine (Volkswagen), and two standard V-8 engines (Chevrolet and Ford). GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N76-33355# Mound Lab., Miamisburg, Ohio.
TECHNIQUES EMPLOYED FOR ULTRASONIC THICKNESS GAUGING OF TRU PLASTIC DRUM LINERS
W. A. Dudley 9 Jan. 1976 6 p refs
(Contract E(33-1)-GEN-53)
(MLM-2278) Avail: NTIS HC $4.00

A ratio method and a direct readout method are described for ultrasonic measurement of the wall thickness of plastic drum liners. Although both procedures use the same commercial equipment and give identical results, the direct readout technique is preferred, because it allows an untrained operator to obtain quality results even though a linear change in longitudinal sound velocity as a function of material thickness is occurring. Author (ERA)

N76-33356# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section Construction Mecanique.
AUTOMATIC TRANSCODING OF PERFORMANCE TAPES FOR NUMERICALLY CONTROLLED MACHINE TOOLS [LA TRANSCODIFICATION AUTOMATIQUE DES RUBANS PERFORES POUR MACHINES-OUTILS A COMMANDE NUMERIQUE]
Luc Soete Feb. 1976 33 p In FRENCH Sponsored by Inst. pour l'Encour. de la Rech. Sci. dans l'Ind. et l'Agr.
(CRIF-MC-58) Avail: NTIS HC $4.00

The transcodification of tapes for numerically controlled machine tools is presented with a view to effecting the transcodification by computer. The interest of the method and its limitations are detailed. A specific procedure is discussed and applied to three examples. ESA

N76-33357# National Bureau of Standards, Washington, D.C.
A PROTOTYPE SEMI-AUTOMATED SYSTEM FOR MEASURING AIR INFILTRATION IN BUILDINGS USING SULFUR HEXAFLUORIDE AS A TRACER Final Technical Note
Charles M. Hunt and Stephen J. Treado Mar. 1976 27 p refs Sponsored in part by NSF
(PB-250958/6; NBS-TN-898) Avail: NTIS HC $4.00 CSCL 13A

A system is described which automatically operates a small gas chromatograph and measures parts per billion concentrations

of sulfur hexafluoride in air. It samples air on a 10 minute cycle and records the response on a strip chart recorder. When SF6 is distributed in the air of a building, data are obtained from which air infiltration rates may be determined. GRA

N76-33358# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
THE NATIONAL MEASUREMENT SYSTEM FOR TIME AND FREQUENCY
Allan S. Risley Jun. 1976 75 p refs
(PB-254074/8; NBS-SP-445-1; LC-76-608114) Avail: NTIS HC $4.50 CSCL 14B

The system is viewed from three vantage points: (1) the instrumentation that provides sources of time and frequency (T and F); (2) the suppliers and users of T and F; and (3) the calibration hierarchies for T and P sources. An attempt is made to determine the technological, scientific, economic, and social effects of the system. GRA

N76-33359# National Bureau of Standards, Washington, D.C. Inst. for Applied Technology.
ENERGY CONSERVATION THROUGH THE FACILITATION OF INCREASED BLENDED CEMENT USE Interim Report, 1 Jul. - 1 Dec. 1975
Paul Wencil Brown, James R. Clifton, and Geoffrey Frosdorff Feb. 1976 28 p refs Sponsored by ERDA
(PB-251218/4; NBSIR-76-1008) Avail: NTIS HC $4.00 CSCL 13C

Portland cement manufacture requires about 2% of the energy consumed annually in the nation's industrial processes. The production of blended cements containing substantial amounts of fly ash or blast furnace slag and their substitution for Portland cement appears attractive from the standpoint of energy conservation. Blended cements account for less than 1% of the total cement production in the U.S. The reasons for the small U.S. production of blended cements are discussed in the contexts of standards revision and the need for the development of additional data as a basis for this revision. GRA

N76-33360# Iowa Inst. of Hydraulic Research, Iowa City.
ECONOMIC ASSESSMENT OF BACKFITTING POWER PLANTS WITH CLOSED-CYCLE COOLING SYSTEMS Final Report, Apr. 1974 - Oct. 1975
A. R. Giaquinta, T. E. Croley, II, V. C. Patel, J. G. Melville, and M. S. Cheng Mar. 1976 387 p refs
(Contract EPA-68-03-0430)
(PB-251189/7; EPA-600/2-76-050) Avail: NTIS HC $10.75 CSCL 13A

A method for assessing the economic consequences of backfitting electric power plants with conventional closed cycle cooling systems is stipulated. Four types of closed cycle systems were investigated: mechanical and natural draft crossflow wet cooling towers, cooling ponds, and spray canals. To estimate operational penalties associated with backfitting, thermodynamic models were used to reproduce the operating characteristics of different types of turbines, condensers, and cooling systems. Capital and operating cost information was compiled and used to evaluate the total differential cost of power production resulting from the backfit. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N76-33361*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
AN EVALUATION OF THE MSBLS/NOSE BOOM INTERFERENCE FOR THE APPROACH AND LANDING TEST
J. M. Tate 28 Feb. 1975 27 p ref
(Contract NAS9-13970)
(NASA-CR-151015; DN-1.3-DN-c0203-007) Avail: NTIS HC $4.00 CSCL 17G

An analysis was performed to investigate whether or not the obstruction caused by boom-mounted probes forward of the Orbiter nose could cause Microwave Scan Beam Landing System (MSBLS) data dropout during the autoland flight phase of the Approach and Landing Test (ALT). The results indicate that there will be no interference from the nose boom to cause MSBLS data dropout for the flight conditions under which the ALT is to be performed. Additional analysis considering approach trajectories in more extreme wind conditions than anticipated for the ALT also indicates that the nose boom creates no interference. Author

N76-33362*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
EVALUATION OF ELECTROSTATIC CHARGE EFFECTS ON THE DATA PROCESSING SYSTEM AND THE ORBITER COMMUNICATION AND TRACKING RECEIVERS
R. M. Lawton 29 Sep. 1975 77 p refs
(Contract NAS9-13970)
(NASA-CR-151018; Rept-1.3-DN-C0304-022) Avail: NTIS HC $5.00 CSCL 17B

An analysis of radiated interference test results obtained from frictionally charged Orbiter TPS tile was presented. The tests included the measurement of noise pick-up by Orbiter S-band, L-band, C-band, and Ku-band antennas located beneath the tiles in a manner simulating their installation on Orbiter. In addition, the radiated field characteristics resulting from the static discharge was determined. The results are analyzed as to their effect on data bus equipment and on Orbiter Communications and Tracking (C&T) receivers. It was concluded that the radiated interference should have no effect on MDM's. However the CPU, IOP and PMU enclosures require some minor modification to assure immunity from P-static interference. Orbiter antenna tests indicate that the S-band receiver should not be affected by P-static noise. The TACAN and Radar Altimeter performance appears to be adequate but with a small margin. MSBLS performance is uncertain because laboratory instrumentation cannot approach the MSBLS sensitivity. Author

N76-33363*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
AN RF LINK ANALYSIS OF MSBLS DURING ALT
Robert E. Speir 5 Sep. 1975 35 p refs
(Contract NAS9-13970)
(NASA-CR-151019; Rept-1.3-DN-C0303-009) Avail: NTIS HC $4.00 CSCL 17G

An analysis of the microwave scanning beam landing system (MSBLS) ground station to orbiter radio frequency (RF) link was made to determine if the expected signal levels will be compatible with orbiter receiver capabilities. Of primary interest was whether or not loss of data will occur due to interference caused by the orbiter 101 nose boom which provides additional air data during the approach and landing test. The results of the analysis indicate that a small amount of data loss may occur due to the proximity of the MSBLS antennas and the nose boom. Tabulated data of antenna radiation patterns are given. Author

N76-33364*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FM/CW RADAR SYSTEM Patent Application
Hans Brey (Sperry Rand Corp., Huntsville, Ala.) and Philip E. Geise, Jr., inventors (to NASA) (Sperry Rand Corp., Huntsville, Ala.) Filed 8 Oct. 1976 12 p Sponsored by NASA
(NASA-Case-MFS-22234-1; US-Patent-Appl-SN-730778) Avail: NTIS HC $3.50 CSCL 17I

A method for improving noise discrimination in an FM/CW radar system is described. The received signal is multiplied by a sample of the transmitted signal, and the product signal is used to deflect a laser beam as a function of frequency. The position of the beam indicates a discrete frequency, and is detected by the frequency encoded positions of an array of photodiodes. The outputs of the photodiodes are scanned, threshold detected, and used to obtain the range and velocity of a target. NASA

N76-33365*# Kanner (Leo) Associates, Redwood City, Calif.
MICROWAVE SENSING OF THE SEA STATE
W. Alpers Washington NASA Oct. 1976 15 p refs Transl.

into ENGLISH of a paper presented at the Symposium on Earth Survey, Porz-Wahn, West Germany, 7-11 Apr. 1975
(Contract NASw-2790)
(NASA-TT-F-17244) Avail: NTIS HC $3.50 CSCL 17I

The application of two active microwave systems, the synthetic aperture side-looking radar and the dual frequency scatterometer, to the remote sensing of ocean waves is discussed. A brief description of the application characteristics of other microwave systems, such as the nanosecond radar altimeter, the dual-frequency radar interferometer, and the microwave radiometer, is also given. The economic utility of sea state forecasting is included. Author

N76-33366*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex.
TRACKER IMPLEMENTATION FOR THE ORBITER KU-BAND COMMUNICATIONS ANTENNA
J. F. Rudnicki and J. F. Lindsey 1 Oct. 1976 166 p refs
(Contract NAS9-14960)
(NASA-CR-150992; DN-B0603-007) Avail: NTIS HC $6.75 CSCL 17B

Possible implementations and recommendations for the Space Shuttle Ku-Band integrated communications/radar antenna tracking system were evaluated. Communication aspects involving the Tracking Data Relay Satellite (TDRS)/Orbiter Ku-Band link are emphasized. Detailed analysis of antenna sizes, gains and signal-to-noise ratios shows the desirability of using maximum size 36-inch diameter dish and a triple channel monopulse. The use of the original baselined 20 inch dish is found to result in excessive acquisition time since the despread signal would be used in the tracking loop. An evaluation of scan procedures which includes vehicle dynamics, designation error, time for acquisition and probability of acquisition shows that the conical scan is preferred since the time for lock-on for relatively slow look angle rates will be significantly shorter than the raster scan. Significant improvement in spherical coverage may be obtained by reorienting the antenna gimbal to obtain maximum blockage overlap. Author

N76-33367# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
RADIATION CHARACTERISTIC EFFECTS BY SURFACE AND ADJUSTMENT ERRORS IN CASSEGRAIN REFLECTOR SYSTEMS [STRAHLUNGSCHARAKTERISTIK-EFFEKTE DURCH OBERFLAECHEN- UND JUSTAGEFEHLER IN CASSEGRAIN-REFLEKTORSYSTEMEN]
G. Ries Jul. 1975 40 p refs In GERMAN; ENGLISH summary
Sponsored by Bundesmin. fuer Verteidigung
(Rept-2-75) Avail: NTIS HC $4.00

A theoretical derivation and discussion is presented for radiation characteristic deformations caused by surface tolerances and errors in the feed and subreflector positionings in Cassegrain antennas. The influences of statistic surface errors on the mean deformation of the pattern are derived. From this, the variances of subreflector and paraboloid errors have equal effects, but the effective correlation region of the subreflector errors is increased by a factor given by the reflector system geometry. The aperture phase errors resulting from small feed and subreflector defocusing are derived by ray tracing methods. It is shown that coma errors and spherical errors in the radiation characteristic caused by lateral and axial subreflector defocusing, respectively, are approximately equal to the errors caused by the same defocusing of a hypothetic prime focus feed. Author (ESA)

N76-33368# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
CONTROL OF ZEROES BY PHASE VARIATION FOR PHASE CONTROLLED ANTENNA ARRAYS [NULLSTELLENSTEUERUNG DURCH PHASENAENDERUNG BEI PHASENGESTEUERTEN GRUPPENANTENNEN]
K. Magura Jul. 1975 40 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(Rept-3-75) Avail: NTIS HC $4.00

Sidelobes in discrete directions can be suppressed by means of iterative superposition of sinusoidal correction phases on the linear phase excitation functions at linear antenna arrays. The resulting array factor variations in the direction of interference and in the mainlobe direction, as well as the beam pointing error, were investigated by calculation. The situation with two or more directions of interference is discussed, supported by pattern examples. The influences of phase quantization on the relevant pattern values are also considered because of their importance for practical realization. It is shown that even at coarse quantization of two or three bits, useful sidelobe suppressions are possible for nearly all beam pointing angles. Author (ESA)

N76-33369# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
INVESTIGATION OF AN ADAPTIVE TWO-ELEMENT SPATIAL FILTER [UNTERSUCHUNGEN AN EINEM ADAPTIVEN ZWEIELEMENT-RAUMFILTER]
J. Ziegenbein and M. Weber Jul. 1975 65 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(Rept-4-75) Avail: NTIS HC $4.50

Theoretical and experimental studies were made on the influence of bandwidth, antenna dimensions, finite integration time, and component tolerances on the maximum attainable signal processing gain. Tests were carried out at 5 kHz in the acoustic range as a model for problems occurring in the case of sonar or radar. Author (ESA)

N76-33370# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
SWEEP AMPLITUDE AT 13.5 - 15.0 GHz AND PHASE PROPAGATION MEASUREMENTS
E. LintzChristensen Apr. 1975 14 p refs Presented at the Intern. Symp. on Probl. of Space- and Terrest. Microwave Propagation, Graz, 1975
(TUD-D-247) Avail: NTIS HC $3.50

Equipment for measurement of amplitude, differential phase, and differential gain of a line of sight propagation path was developed for sweep measurements over the frequency band 13.5 to 15.0 GHz to obtain data for propagation prediction at frequencies above 10 GHz. This equipment was in operation since June 1974 on an overland path of 44.7 km in Denmark. Rain gages are situated along the path in order to obtain statistical information on rain and snow simultaneously with the propagation measurements. The system of measuring amplitude and phase versus frequency using a continuously sweeping carrier which is frequency modulated with the test frequency is described and its performance characteristics presented. ESA

N76-33371# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
POLARIZATION MEASUREMENTS BY USE OF AN ARBITRARILY POLARIZED STANDARD ANTENNA
Flemming Jensen May 1975 10 p refs
(TUD-D-254) Avail: NTIS HC $3.50

Some of the most commonly applied polarization measurement methods are based on the use of ideal linearly polarized standard antennas. These methods are with respect to the use of standard antennas having arbitrary, but known, polarization properties. Author (ESA)

N76-33372# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
GRAVITATIONAL ANTENNA SENSITIVITY [SENSIBILITA DI UN ANTENNA GRAVITAZIONALE]
G. V. Pallottino and G. Pizzella Feb. 1975 21 p refs In ITALIAN
(LPS-75-4) Avail: NTIS HC $3.50

The sensitivity of gravitational waves detection experiments is discussed taking into consideration each of the elements (antenna, piezoelectric transducers, amplifiers) as a combination of signal and noise. A mathematical model was derived. A comparison between various types of experiment was made in which the shape of the antenna and the type of transducers varies. The best results were obtained with a small antenna with a transducer PZT-7A under the assumption that Q = 30,000. ESA

N76-33373# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
STUDY OF THE GRAVITATIONAL ANTENNA AS DISSIPA-

TIVE AND DISPERSIVE TRANSMISSION LINE [STUDIO DELL'ANTENNA GRAVITAZIONALE COME LINEA DI TRASMISSIONE DISSIPATIVA E DISPERSIVA]
V. Ferrari Apr. 1976 39 p refs In ITALIAN
(LPS-76-12) Avail: NTIS HC $4.00

The gravitational wave antenna is considered, through a mechanical to electric analogy, as a distributed dispersive and dissipative electric line. The propagation mechanism was studied using this simulation. Having calculated the antenna equation, an attempt was made to analyze it in the one-dimensional approximation. The transfer function was found but could not be transformed back. Numerical calculations did not yield positive results. Theoretical calculation of the rise time are given together with analytic antitransformation of the transfer function. ESA

N76-33374# Fondazione Ugo Bordoni, Rome (Italy). Centro Onde Millimetriche.
DIGITAL ANALYSIS OF SUPERIOR ELECTRIC CIRCULAR MODE FILTERS [ANALISI NUMERICA DI FILTRI PER I MODI CIRCOLARI ELETTRICI SUPERIORI]
Gabriele Falciasecca and Sergio Rogai 14 Nov. 1975 37 p refs In ITALIAN
Avail: NTIS HC $4.00

A computer program to calculate the parameters of an electric filter for higher circular modes is presented. Starting from a circular wave guide sliced along a diametral plane, a phase shift is introduced by a dielectric concentric solid half cylinder while the restitution of the original phase is performed on the other half volume using a concentric dielectric shell. The various parameters involved are discussed with regard to attenuation of higher modes. An example is given of a filter of good characteristics up to 60 GHz. The underlying mathematical analysis is outlined. ESA

N76-33375# Fondazione Ugo Bordoni, Rome (Italy).
VOCAL SOUND RECOGNITION AS DURATION FUNCTION. PART 2: DIGITAL PROCESSING TECHNIQUE [RICONOSCIMENTO DEI SUONI VOCALI IN FUNZIONE DELLA DURATA. NOTA 2: TECNICA DI ELABORAZIONE NUMERICA]
G. Ibba, A. Paolini, G. Campanini, and P. Pocci 6 Dec. 1975 33 p refs In ITALIAN
Avail: NTIS HC $4.00

The problem of recognizing speech sounds as a function of their duration is considered using digital techniques with the aim of reducing the necessary length of any signal to a few milliseconds. The methods used to segment vowels are described with regard to programming a PDP 11/15 for that purpose. Subjective recognition experiments established that one Foer is sufficient to unambiguously recognize a vowel. In the case where the segmentation is pursued up to 0.1 to 0.2 Foers, it is necessary to equalize the energies carried by the various phonetic elements. ESA

N76-33376# Fondazione Ugo Bordoni, Rome (Italy).
VOCAL SIGNAL CODERS [CODIFICATORI DI SEGNALE VOCALE]
Francesco Villani 30 May 1975 38 p refs In ITALIAN
Avail: NTIS HC $4.00

The various types of vocoders that could be used in urban telephony networks are reviewed. The specifications to be satisfied are indicated together with the performances of the enders. The PCM and Delta modulation types of vocoders are detailed and their applicability compared. ESA

N76-33377# Fondazione Ugo Bordoni, Rome (Italy). Centro Onde Millimetriche.
ATTENUATION INCREMENT FOR INTENTIONAL CURVES AND SERPENTINES IN CIRCULAR WAVEGUIDES [INCREMENTO DI ATTENUAZIONE PER CURVE INTENZIONALI E SERPENTINE DI POSA IN GUIDA D'ONDA CIRCOLARE]
Sergio Rogai 7 Nov. 1975 31 p refs In ITALIAN
Avail: NTIS HC $4.00

The mathematical experiments needed to calculate the increase in attenuation suffered by waves in a curved circular waveguide are presented. The case of elastic bending of supporting pillars is treated. ESA

N76-33378# Fondazione Ugo Bordoni, Rome (Italy).
CHARACTER ALIGNMENT FOR HIGH CAPACITY PCM SYSTEMS USING MS43 LINE CODE
Odoardo Brugia, Maurizio Decina (Soc. Ital. per l'Esercizio Telefonico), and Umberto deJulio (Soc. Ital. per l'Esercizio Telefonico) 12 Jun. 1974 31 p refs Submitted for publication
Avail: NTIS HC $4.00

Character alignment problems were investigated with special reference to the pseudoternary code MS43. The self aligning characteristics of this code are discussed. The statistical properties of the alignment loss and recovery processes for the MS43 code were analyzed theoretically and by computer simulation with reference to the method of recognition of the constraints and correlations due to the conversion rules of the alphabetic code and to a strategy similar to the one used for frame alignment in PCM-TDM systems. The results of the investigation were used to design the character alignment strategy for a 34.368 Mbit/s PCM system using MS43 as a line code. ESA

N76-33379# Alabama Univ., Huntsville.
A STUDY OF THE G-H-K TRACKING FILTER, VOLUME 1 Final Technical Report, 1 Jun. 1974 - 31 Jul. 1975
Robert J. Polge and B. K. Bhagavan Jul. 1975 76 p refs
(Contract DAAH01-71-C-1181; DA Proj. 1M2-62303-A-214) (AD-A021317; UAH-RR-176-Vol-1; RE-CR-76-1-Vol-1) Avail: NTIS CSCL 17/9

This report is concerned with the investigation of the G-H-K filter for tracking maneuvering targets. The selection of the filter coefficients is based on the amounts of noise and maneuver, and other system considerations such as critical damping or best transient response for specified smoothing. Several filter initialization schemes were tested. For low acceleration maneuvers, a considerable amount of smoothing can be achieved without losing track. However, in order to track severely maneuvering targets, one must select coefficients which give a faster transient response at the expense of smoothing capability. Therefore, it is logical to use an adaptive filter with a good smoothing capability when the target is not maneuvering and a fast response during a target maneuver. Clearly, the main problem is to detect the maneuver in a reasonable amount of time. This can be done using a simplified matched filter followed by a threshold detector. The proposed adaptive filter was evaluated through computer simulation using typical trajectories. The performance of the adaptive filter is limited by the number of samples required by the detection filter and could probably be improved using a more complex maneuver detection filter. Author (GRA)

N76-33380# Alabama Univ., Huntsville.
QUANTIZATION EFFECTS IN DIGITAL MTI FILTERS, VOLUME 2 Final Technical Report, 1 Jun. 1974 - 31 Jul. 1975
Robert J. Polge, B. K. Bhagavan, and L. Callas Aug. 1975 247 p refs
(Contract DAAH01-71-C-1181; DA Proj. 1M2-62303-A-214) (AD-A021318; UAH-RR-179-Vol-2; RE-CR-76-2-Vol-2) Avail: NTIS CSCL 17/9

The purpose of this report is to design and select MTI filters which will satisfy given specifications with tolerable quantization effects and a minimum amount of hardware. Programs are developed to design low-pass, high-pass, band-pass and band-reject filters of types Butterworth, Chebyshev I, Chebyshev 2 and elliptic. The transfer function is factored into second-order and first-order sections, and five realizations are considered: direct, canonical, modified canonical, coupled canonical and Mick's. Binary fixed-point two's complement arithmetic is assumed. A simulation program is developed for a typical nonrecursive filter. Programs are developed to design, evaluate, and select high-pass and band-pass MTI recursive filters. It is shown that Chebyshev I, Mick's realization, is the recommended choice for a typical MTI filter. Author (GRA)

N76-33381# Ohio State Univ., Columbus. ElectroScience Lab.
TARGET IMAGING FROM MULTIPLE FREQUENCY RADAR DATA Final Technical Report, 1 May 1974 - 31 Oct. 1975
K. A. Shubert, J. D. Young, and D. L. Moffatt Griffiss AFB,

N. Y. RADC Feb. 1976 139 p refs
(Contract F30602-74-C-0170; AF Proj. 4506)
(AD-A022202; ESL-3919-7; RADC-TR-76-45) Avail: NTIS CSCL 17/9

A basic process for producing three-dimensional isometric images of a radar target from measured multiple frequency scattering data has been modified to image targets with more complex geometrical shape from non-mutually orthogonal look angle data. Other modifications include changes in the use of the physical optics approximation beyond the shadow boundary, use of polarization diversity information, and estimates of the length to width ratio of the target are given and illustrated. Images produced using these modifications are presented. Recommendations for further research to provide a more versatile imaging procedure are made. The computer programs presently used in the imaging process are given in appendices of the final report. Author (GRA)

N76-33382# Office of Telecommunications, Washington, D.C.
A SURVEY OF ATMOSPHERIC OPTICAL COMMUNICATION SYSTEMS
J. R. Baird and J. R. Clark Dec. 1975 31 p refs
(PB-249974/7; OTR-75-1) Avail: NTIS HC $4.00 CSCL 17B

This report is a survey, current to mid-1975, of atmospheric optical telecommunication systems. Atmospheric systems are understood in the broad sense as all those systems which do not use a confined optical wave-guiding structure, such as a glass fiber, for the transmission medium. Included in this survey are (1) a summary of system types and their dominant problems, (2) an enumeration of prominent commercially available systems, and important prototype systems, (3) identification and review of related ongoing research, (4) a summary of current technology and available components; (5) an assessment of systems needs and technological gaps; and (6) a discussion of technical and economic considerations. The survey is selective rather than exhaustive. GRA

N76-33383# Marquette Univ., Milwaukee, Wis. Dept. of Electrical Engineering.
THE DESIGN AND TESTING OF A SYSTEM FOR FORMANT TRACKING OF VOICED SPEECH Final Report
Roger M. Vilmur and Russell J. Niederjohn Sep. 1975 79 p
(Grant NSF GK-37454)
(PB-252484/1; EE-75-3) Avail: NTIS HC $5.00 CSCL 17B

The development and testing of an automatic system for tracking the first three formant frequencies in speech recognition is described. The method used involves both a frequency domain analysis and a time domain analysis. A rough frequency domain analysis is performed with a bank of fixed bandpass filters. The amplitude of the signal in each filter is measured. In addition, an accurate time domain analysis is performed using a measure of the consistency of the crossing intervals from each filter. The acquired data is then used in a computer algorithm to determine the formant frequencies. A description and operation of all hardware and software components is included. GRA

N76-33384# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.
MAN-MADE NOISE: THE PROBLEM AND RECOMMENDED STEPS TOWARD SOLUTION
A. D. Spaulding Apr. 1976 187 p refs
(PB-253745/4; OTR-76-85) Avail: NTIS HC $7.50 CSCL 17B

Man-made noise causes interference which is, quite often, the limiting factor in communications/electronics system performance. Examples of degradation to systems by man-made noise are given. It is shown that both technically and economically, further suppression of automotive ignition noise at the manufacturing level is required. Means of achieving this required suppression are given. Programs for noise measurement, analysis, and model development are summarized, and recommendations for attaining required additional information on the noise environments are given. In addition, the role that better information on the noise environment plays in the proper management of the spectrum resource is covered. GRA

N76-33385# Middleton (David), New York.
STATISTICAL-PHYSICAL MODELS OF MAN-MADE AND NATURAL RADIO NOISE. PART 2: FIRST ORDER PROBABILITY MODELS OF THE ENVELOPE AND PHASE
David Middleton Apr. 1976 148 p refs
(Contract COM-OT-0124)
(PB-253949/2; OTR-76-86-Pt-2) Avail: NTIS HC $6.00 CSCL 17B

The development of analytically tractable, experimentally verifiable, statistical physical models of electromagnetic interference is described. Classification into three major types of noise is made: class A (narrowband vis-a-vis the receiver), class B (broadband vis-a-vis the receiver), and class C (= class A + class B). First order statistical models are constructed for the class A and class B cases. In particular, the APD (a posteriori probability distribution) or exceedance probability, PD, and the associated probability densities of the envelope are obtained. GRA

N76-33386# Manned Systems Sciences, Inc., Northridge, Calif.
A COMPUTER MODEL FOR COMMAND AND CONTROL ANALYSIS
Richard W. Obermayer Nov. 1975 55 p refs
(Contract N00014-74-C-0324; NR Proj. 274-244)
(AD-A024567) Avail: NTIS CSCL 17/2

One approach to the evaluation of manned systems and their command and control elements is direct empirical observation. However, direct measurement, and especially the analytic study of system variables by systematically altering conditions within a manned system, are often either impractical or can be performed to only a limited degree. A model of the system which allows the variations needed for assessment of a command and control element may therefore be an effective alternative, and a computer model for such purposes is sought in this paper. The purpose of this paper is to report the development of this model, using the General Purpose System Simulator (GPSS) language in the construction of an example simulation of a Carrier Air Traffic Control Center (CATCC), and to present techniques and guidelines for constructing similar models of other manned systems. Author (GRA)

N76-33387# Manned Systems Sciences, Inc., Northridge, Calif.
AN ANALYSIS AND EVALUATION METHODOLOGY FOR COMMAND AND CONTROL Final Technical Report
Dorothy L. Finley, Frederick A. Muckler, Charles A. Gainer, and Richard W. Bermayer Nov. 1975 96 p refs
(Contract N00014-74-C-0324; NR Proj. 274-244)
(AD-A023871) Avail: NTIS CSCL 17/2

The program concerned problems in assessing the status, potentials, and weaknesses of operational manned systems and of dealing analytically with that variance in system behavior attributable to its human members. As the core problem is the behavior of the responsible system element, Command and Control (C and C), the specific question addressed was, 'How can the effectiveness and performance of operational C and C be better measured, analyzed, and evaluated.' These problems were resolved through the development of methods and a methodological framework for dealing with C and C as an integral part of systems. The framework consists of analysis process stages conceived to take place prior to quantitative data analysis. The foundational concepts of the methodology include definitions of C and C, taxonomization, the Systems Taxonomy Model, systems description discussions, ideas for the use of operator models, and analytic decision-making concepts. GRA

N76-33388# Singer Co., Sunnyvale, Calif. Simulation Products Div.
SIMPLIFIED RADAR AZIMUTH BEAMSPREAD STUDY Final Report, 10 May - 19 Dec. 1975
David Windsor 19 Dec. 1975 58 p
(Contract F33657-73-C-0692; AF Proj. 1183)
(AD-A022618; UC-7256) Avail: NTIS CSCL 17/9

This report describes a study for a simplified beamspread simulation for use in digital radar landmass simulators. Four new beamspread algorithms are presented which require less memory and computing hardware than those found in currently available systems. Computer-generated photographs are included to give a direct visual comparison of the effects of the new algorithms with the effects of the beamspread algorithm in the F-4F DRLMS. Author (GRA)

N76-33389# Naval Research Lab., Washington, D.C.
AIRBORNE RADAR MOTION COMPENSATION TECHNIQUES: OPTIMUM ARRAY CORRECTION PATTERNS Interim Report
G. A. Andrews, Jr. 16 Mar. 1976 31 p refs
(WF12141601)
(AD-A022841; NRL-7977) Avail: NTIS CSCL 17/9

Moving Target Indicators (MTIs) on moving platforms present a special problem of clutter cancellation because of the motion of the platform in relation to fixed objects. The returns from fixed objects must be filtered out as clutter. A technique was developed for designing antenna correction patterns to minimize clutter residue, averaged over all angles. It is to be used with the Displaced Phase Center Antenna (DPCA) system and can achieve and average clutter cancellation equal to that of an MTI on a stationary platform. Author (GRA)

N76-33390# Naval Research Lab., Washington, D.C.
A COMPUTER PROGRAM FOR COMPUTATION OF RADAR DETECTION RANGES ON A CONSTANT-ALTITUDE TARGET IN VARIOUS ENVIRONMENTS Interim Report
J. K. Hsiao Mar. 1976 129 p refs
(NRL Proj. R12-10; SF12141402)
(AD-A023474; NRL-MR-3234) Avail: NTIS CSCL 17/9

In this report a computer program which plots the signal strength of a constant-altitude target over the sea surface is described. The signal strength is plotted, as a function of range, normalized to the signal-to-noise ratio required for a given probability of detection and probability of false alarm in the presence of receiver noise only. The range at which this S/N ratio is obtained in the absence of multipath effects, and when the signal competes only with receiver noise, is defined as the free-space range. To examine the detection range of a target in the presence of clutter and jamming signals, a new threshold is computed which is equal to the ratio of the total noise power (jamming plus noise) to the receiver noise power. This program was originally developed by Blake. In this report, modifications to the program to include MTI and doppler filtering are described. A program listing and example computations are included.
Author (GRA)

N76-33391# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OPTIMUM ELEVATION ANGLE ESTIMATION IN THE PRESENCE OF GROUND REFLECTION MULTIPATH
Robert J. McAulay 9 Feb. 1976 76 p refs
(Contract F19628-76-C-0002; AF Proj. 649L)
(AD-A023247; TN-1976-11; ESD-TR-76-35) Avail: NTIS CSCL 17/9

Radars that are developed for the purpose of monitoring aircraft landings in the terminal Air Traffic Control system can be designed to exploit the relatively high signal-to-noise ratio that characterizes the power budgets calculated for such a link. An interferometer using a pair of low gain antennas can be used to obtain passive coverage over a large azimuth and elevation sector. A large base line can be used to obtain the desired elevation angle estimation accuracy. An optimal tradeoff between the width of the subarray aperture and the width of the interferometer base line is performed that achieves a specified elevation angle estimation error while minimizing the overall height of the interferometer configuration. The algorithm searches through the class of antenna patterns that can be synthesized from so-called finite impulse, linear phase digital filters. In Part II, the design of a separate sensor for resolving the interferometer ambiguities is formulated as a hypothesis testing problem and solved using statistical decision theory. A bound on the probability of an ambiguity error is derived that accounts for the effects of ground reflection multipath and receiver noise. Acceptable performance can be achieved using a 4-element non-uniformly spaced array (0, 3.2, 6.4, 11.2 wavelengths) with relatively inexpensive dipole antennas mounted on tri-plane reflectors.
GRA

N76-33392# Stanford Research Inst., Menlo Park, Calif.
LOW-ANGLE RADAR TRACKING
A. M. Peterson, F. W. Perkins, J. F. Verecky, R. A. Muller, and A. M. Despain Feb. 1976 115 p refs
(Contract DAHC15-73-C-0370; ARPA Order 2504; SRI Proj. 3000)
(AD-A023265; SRI-JSR-74-7) Avail: NTIS CSCL 17/9

A review of the problem of tracking low-elevation-angle radar targets is presented. Central to this problem is the scattering of the target return signals from the surrounding land or water surface. Thus the present state of electromagnetic-waves scattering theory is reviewed as it applies to this problem. Scattering at low grazing angles is given special attention, and some relevant lunar bistatic radar data are compared with current theory. Various radar system design considerations and possibilities for improving current systems are considered. It is concluded that both scattering theory and experimental measurements of radar signal scattering should be further developed. It is apparent that a very large variety of techniques can be used to improve low-angle tracking capability in the future and even in current systems. It is also clear that in the future, radar systems could have considerably improved low-angle tracking ability.
Author (GRA)

N76-33393# Stanford Univ., Calif. Radioscience Lab.
A FREQUENCY-TRACKING DIRECTION FINDER FOR WHISTLERS AND OTHER VERY LOW FREQUENCY SIGNALS
Mark Keith Leavitt Dec. 1975 185 p refs
(Contract N00014-67-A-0012; Grants NSF GV-41369)
(AD-A022834; SU-SEL-76-001; SU-TR-3456-2) Avail: NTIS CSCL 17/3

Whistlers and related very low frequency radio signals are guided in ducts of enhanced or reduced ionization along the geomagnetic lines of force of the earth's magnetosphere. The signals convey information about the distribution of particles in the plasma through which they have propagated and about the occurrence of wave-particle interactions in the magnetosphere. Direction-finding on such signals will aid in locating the ducts and measuring their temporal drifts, thus making an important contribution to studies of magnetospheric convection. The signals, although narrowband in nature, exhibit wide frequency excursions in the 1 to 10 kilohertz range. An innovative technique is presented for tracking these frequency excursions in real time to produce a filtered, quasimonochromatic version of the signal. The voltages induced by the incident wave on two orthogonal loop antennas and a vertical monopole antenna are processed by this method. The filtered signals are then cross-multiplied in a manner analogous to a Poynting vector calculation to obtain a continuous indication of the wave direction of arrival. The design, construction, and laboratory testing of a prototype instrument are described. Field testing of the instrument was performed at Stanford, California, and Roberval, Quebec, Canada. Operating at fixed frequencies, the direction-finder produced accurate results on VLF transmissions in the 10 to 20 kilohertz range from NAA, NPG, GBR, and the Omega stations. GRA

N76-33394# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
ENVIRONMENT AND RADAR OPERATION SIMULATOR Quarterly Report, 1 Jul. - 30 Sep. 1975
S. N. Cole, A. R. Clayton, R. C. Michelson, and E. S. Joberg Dec. 1975 40 p refs
(Contract DAAB07-74-C-0272; DA Proj. 1S7-62703-DH-93)
(AD-A022165; ECOM-74-0272-5; QR-5) Avail: NTIS CSCL 17/9

System analysis was performed in the areas of digital filter design for performing clutter synthesis and real-time software for processing prerecorded target signals. In preparation for hardware implementation, circuit board standards have been determined, and a circuit information program was developed to be used as an aid in deriving cost and schedule requirements for hardware implementation. As a result of the digital filter analysis, a two-pole filter has been selected which provides the variety and flexibility needed to synthesize ground clutter. An investigation of quantization indicates that 16-bit arithmetic will be needed during the filter's computation. The major computational burden imposed upon the real-time software is the processing of prerecorded data coupled with the computation of antenna gain. Timing analyses indicate that the antenna gain multiplications should be performed in the EROS digital processor, that provision is needed for blocking the output target data to the EROS digital processor, and that the number of simulated

targets be restricted to one or two. Two 2-target simulation modes and one 1-target simulation modes are described. GRA

N76-33395# State Univ. of New York, Albany.
SCATTERING OF ELECTROMAGNETIC RADIATION BY APERTURES. 9: SURFACE CURRENT DISTRIBUTION OVER A CLOSED CYLINDRICAL CAN AT BROADSIDE INCIDENCE
Louis F. Libelo and C. Luther Andrews Feb. 1976 89 p refs
(Contract N60921-75-C-0131; DNA Proj. NWED-QAXRB088)
(AD-A024457; NSWC-TR-75-163) Avail: NTIS CSCL 20/14

Circumferential scans of the components of surface current were obtained on a finite length circular conducting tube. The tube ends were closed via flat end caps. Both polarizations of CW radiation were used to irradiate the target at broadside incidence. Author (GRA)

N76-33396# Rockwell International Corp., Dallas, Tex.
PACKET RADIO COMMUNICATIONS Quarterly Technical Report
J. C. Garrett 1 May 1976 113 p refs
(Contract DAHC15-73-C-0192; ARPA Order 2305)
(AD-A024424; Rept-523-0602169-001C3L) Avail: NTIS CSCL 17/2

The results of an investigation of size reduction of the packet radio are present in this document. These results include: (1) The identification of the limitations and constraints to size reduction of the packet radio; (2) Solutions and alternatives to these constraints; and (3) Design exercise for a small packet radio. Author (GRA)

N76-33397# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
ELECTROMAGNETIC SCATTERING BY A LINEARLY OSCILLATING TARGET Physical Sciences Research Papers
Ralph E. Kleinman 20 Oct. 1975 38 p refs
(AF Proj. 5635)
(AD-A024001; AFCRL-PSRP-648; AFCRL-TR-75-0554) Avail: NTIS CSCL 17/9

A theoretical analysis is presented in this report which shows that when a plane electromagnetic wave is incident upon a perfectly conducting, linearly oscillating, arbitrarily shaped target, the scattered far field differs only in phase from the field scattered when the target is motionless. The explicit form of the phase modulation factor is derived to an accuracy of the order of v/c, where v and c are the velocities of target motion and electromagnetic waves respectively. Spectral analysis of the modulation shows that the power distribution varies with the shape of the motion, wavelength of the incident field, and magnitude of the projections of the oscillation in the incident and receiver directions. Power spectra are calculated for square, triangular, and sinusoidal periodic target motion as well as a superposition of two sinusoids of different frequency and amplitude. The results indicate that even small amplitude oscillations produce measurable modulations of the scatter field. Author (GRA)

N76-33398# Armament Development and Test Center, Eglin AFB, Fla.
RAT SCAT EVALUATION OF COMMERCIALLY AVAILABLE RADAR ABSORBING MATERIALS, VOLUME 1 Final Report
William OHara Mar. 1976 229 p refs
(AD-A024469; ADTC-TR-76-23-Vol-1) Avail: NTIS CSCL 17/4

This report summarizes performance evaluation tests on a variety of commercially available thin flexible sheet type radar absorber materials, including both resonant and non-resonant types. A corner reflector test technique was used which allowed test and evaluation of the absorber at both normal incidence and grazing angles out to ninety (90) degrees. Fourteen types of RAM were tested at frequencies near 11, 13, 17 and 35 GHz. The higher frequency data and off-normal incidence data in this report are often unavailable in RAM manufacturers literature. RAM types tested include: FGM-40, ANW-73, ANP-74XP, AN-73, AN-72, AN-75, ANP-73, NRL-2764B, SF-14, GRAM-52 and NR-95. This report provides reproductions of the data runs taken and 5 degree median plots of each run. The measurement configurations and parameters for each cut are identified on each pattern with an overall summary chart included in the main body of the report. GRA

N76-33399# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
ADAPTIVE BASEBAND DIGITAL COMMUNICATION AND APPLICABLE CONVERGENCE RESULTS Final Report
David C. Farden May 1976 54 p refs
(Contract N66001-75-C-0224; ARPA Order 1872)
(AD-A024535) Avail: NTIS CSCL 17/2

Several baseband adaptive communication systems are presented and analyzed with regard to 'self-synchronization' properties, intersymbol interference, and convergence properties. Recent convergence results, the proofs of which are contained in a companion report, are applied to provide extremely mild 'covariance decay-rate conditioners' for which the algorithms treated converge with probability 1. Of special interest are the convergence results treating correlated cyclostationary training data. Recent results on maximum likelihood sequence estimation are extended to treat the detection of general 'nonlinearly modulated' digital data over linear dispersive channels and nonwhite additive noise. Adaptive techniques for training the new detector structure are proposed for use when the channel and/or the noise covariance function are unknown.
Author (GRA)

N76-33400# IIT Research Inst., Annapolis, Md.
AUTOMATED VHF FREQUENCY ASSIGNMENT SYSTEM (FAS) FOR FAA AIR TRAFFIC CONTROL COMMUNICATIONS Final Report
Thomas Hensler Feb. 1976 98 p refs Revised
(Contracts F19628-76-C-0017; DOT-FA70WAI-175; AF Proj. 649E)
(AD-A024428; ECAC-PR-76-005; FAA-RD-76-14) Avail: NTIS CSCL 17/2

An automated frequency assignment system (FAS) was developed as a means of providing frequency assignment plans for FAA Air Traffic Control (ATC) VHF communications facilities. The FAS consists of a series of computer models (described herein). Examples are included of how the model inputs can be varied to investigate the advantages of different assignment procedures. The system can be used for assignment gaming, including partial and complete assignments, detecting violators, statistical analyses, and plots of service volume. GRA

N76-33401# IIT Research Inst., Chicago, Ill.
AN ASSESSMENT OF POSSIBLE ELF INTERFERENCE PROBLEMS AT K. I. SAWYER AIR FORCE BASE
Louis Valcik and Michael Genge Apr. 1976 34 p refs
(Contract N00039-76-C-0141)
(AD-A024530; IITRI-E6357-TR-3) Avail: NTIS CSCL 17/2

The technical effort reported herein concerns a review and analysis of the electromagnetic compatibility considerations associated with possible installation of Seafarer extremely low frequency equipment and antennas on or near K. I. Sawyer Air Force Base, Michigan. Author (GRA)

N76-33402# Naval Research Lab., Washington, D.C.
MODULATION OF MICROWAVE BACKSCATTER BY GRAVITY WAVES IN A WAVE TANK Interim Report
W. C. Keller and J. W. Wright 29 Mar. 1976 25 p refs
(NRL Proj. G01-14; RR0310341)
(AD-A024048; NRL-7968) Avail: NTIS CSCL 17/9

Modulation of coherent microwave backscatter at 9.375 GHz, vertical polization, and at a depression angle of 45 deg has been measured in a wind wave tank as a function of windspeed, modulating wave frequency, and amplitude. A relaxation time model can be used to describe the phase and magnitude of the modulation for windspeeds of less than about 7 to 8 m/s and wave slopes of less than about 0.1; the magnitude of the modulation depends strongly on windspeed and direction. Marked deviations from the model occur at the highest wind utilized (10 m/s), and the small-scale wind-generated waves coalesce near or behind the crests of the modulating wave. The orbital velocity of the large waves is deduced to an accuracy of a 3 cm/s or 10% from the measurements of modulated Doppler shift, though the phase of the modulated Doppler shift exhibits windspeed dependence apparently due to the wind drift. Mean

scattering cross sections show a substantial dependence on modulating wave amplitude for intermediate windspeeds. The implication of the measurements for radar imaging of ocean waves is discussed. It is concluded that the modulation of line-of-sight scatterer speed is a much more reliable measure of ocean wave amplitude than the amplitude modulation of backscattered power. Author (GRA)

N76-33403# Dikewood Corp., Albuquerque, N.Mex.
A NUMERICAL SOLUTION PROCEDURE FOR SMALL APERTURE INTEGRAL EQUATIONS Final Report, Sep. 1973 - Jun. 1974
K. R. Umashankar and Chalmers M. Butler Jan. 1976 38 p refs Prepared in cooperation with Miss. Univ.
(Contract F29601-74-C-0010)
(AD-A023686; DC-TN-7204-2; AFWL-TR-74-193) Avail: NTIS CSCL 20/14

A procedure is presented for numerically obtaining solutions of the small aperture integral equations developed in Interaction Note 149. The results of the solution technique provide knowledge of the distribution of electric field (or equivalent magnetic current) in the aperture due to arbitrary plane wave illumination and valid to zeroth and first order in reciprocal wavelength. Author (GRA)

N76-33404# British Library Lending Div., Boston Spa (England).
FAX: A STUDY OF PRINCIPLES, PRACTICE AND PROSPECTS FOR FACSIMILE TRANSMISSION IN THE UK
R. Barrett and B. J. Farbrother Nov. 1975 47 p refs
(BLL-RLRD-5257-(2113.56F); ISBN-0-85350-136-X) Avail: British Library Lending Div., Boston Spa, Engl.

Although facsimile transmission was originally used primarily to transmit graphical images, the recent growth of information generation and dissemination has increased its potential. Facsimile is now playing an increasingly important role in information transfer generally because of its accuracy, convenience and low labor requirements. The biggest obstacle to the growth of facsimile has probably been the relatively high cost of transmitting the facsimile image, since most of the cost of a six minute transmission of a document over the telephone network is comprised of the cost of the telephone call. This has led to the view that the facsimile market would only take off when machines were developed which were capable of processing the information in such a way that it could be transmitted in one minute or less. In actual fact, the number of facsimile machines installed in the United States has soared from less than 50,000 to over 100,000 in little more than two years, without a major supplier providing such a facility. However, one machine of this type has recently come on the market in the United Kingdom and all major suppliers are known to have sub-one-minute machines in some state of development. The general introduction of such machines at an economic price will greatly increase the use of facsimile. Author

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N76-33405*# M&S Computing, Inc., Huntsville, Ala.
PRINTED WIRING BOARD SYSTEM PROGRAMMER'S MANUAL
C. D. Brinkerhoff Marshall Space Flight Center NASA 25 Apr. 1973 80 p refs
(Contract NAS8-25261)
(NASA-CR-149966; Rept-73-0013) Avail: NTIS HC $5.00 CSCL 09A

The printed wiring board system provides automated techniques for the design of printed circuit boards and hybrid circuit boards. The system consists of four programs: (1) the preprocessor program combines user supplied data and predefined library data to produce the detailed circuit description data; (2) the placement program assigns circuit components to specific areas of the board in a manner that optimizes the total interconnection length of the circuit; (3) the organizer program assigns pin interconnections to specific board levels and determines the optimal order in which the router program should attempt to layout the paths connecting the pins; and (4) the router program determines the wire paths which are to be used to connect each input pin pair on the circuit board. This document is intended to serve as a programmer's reference manual for the printed wiring board system. A detailed description of the internal logic and flow of the printed wiring board programs is included. Author

N76-33406*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EVALUATION OF A HIGH POWER INVERTER FOR POTENTIAL SPACE APPLICATIONS
Buddy V. Guynes and John R. Lanier, Jr. Aug. 1976 62 p
(NASA-TM-X-73341) Avail: NTIS HC $4.50 CSCL 09C

The ADM-006 inverter discussed utilizes a unique method of using power switching circuits to produce three-phase low harmonic content voltages without any significant filtering. This method is referred to as the power center approach to inverter design and is explained briefly. The results are presented of tests performed by MSFC to evaluate inverter performance, especially when required to provide power to nonlinear loads such as half or full wave rectified loads with capacitive filtering. Test preocedures and results are described. These tests show that the power center inverter essentially met or exceeded all of claims excluding voltage regulation (3.9 percent versus specified 3.3 percent) and would be a good candidate for high power inverter applications such as may be found on Space Station, Spacelab, etc. Author

N76-33407# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
RADIATION HARDENED 64-BIT CMOS/SOS RAM
R. A. Kjar, B. E. Peterson, and J. T. Blandford Sep. 1976 6 p refs Presented at IEEE Annual Conference on Nuclear and Space Radiation Effects, San Diego, Calif., 27-30 Jul. 1976
(X76-1054/501) Avail: NTIS HC $3.50

Radiation hardening procedures were implemented in the design, analysis and fabrication of a 64-bit metal oxide and SOS semiconductors. A moderately complex (714 transistors), dielectrically isolated integrated circuit was developed which features high performance and high radiation tolerance. Typical electrical parameters include 120 nsec read-access time and 1 microwatt/bit standby power dissipation. The SOS construction minimizes radiation-induced transient photocurrents while a hardened gate insulator provides immunity to total dose effects. Transient radiation upset levels exceed 30 million kilorads(Si)/sec for short (less than or equal to 50 nanosecs) pulses and ionizing dose hardness exceeds 1 million rads(Si). A neutron fluence of 3.65 million n/sq micron had no effect on circuit operation beyond that expected from the ionizing radiation alone. Author

N76-33408# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
PROMPT RADIATION DAMAGE AND SHORT TERM ANNEALING IN CMOS/SOS DEVICES
J. C. Pickel and R. A. Williams Sep. 1976 8 p refs Presented to IEEE Annual Conf. on Nuclear and Space Radiation Effects, San Diego, Calif., 27-30 Jul. 1976
(X76-1051/501) Avail: NTIS HC $3.50

The radiation induced damage and the subsequent short term annealing metal oxide and SOS semiconductor devices were experimentally investigated. Transient threshold voltage shifts were measured after exposure to prompt ionization pulses. The measurements concentrated on early annealing, within 100 microseconds after the ionization pulse. The data demonstrate that the threshold shift is independent of dose-rate for prompt (less than 30 nanoseconds) ionization. The annealing rate is shown to be a strong function of temperature with no annealing occurring at -195 C and an enhanced annealing rate at 125 C. The data demonstrate that, at room temperature and for zero field in the gate oxide, there is no significant annealing occurring before one microsecond after a prompt pulse. Threshold shift is shown

to be proportional to the square of the gate oxide thickness. Threshold shift and annealing rate are shown to be dependent on the magnitude and polarity of the field in the gate oxide.
Author

N76-33409# Atomic Energy Establishment, Winfrith (England). Reactor Group.
SUPPRESSION OF RELAY INTERFERENCE WITH PARTICULAR REFERENCE TO NUCLEAR REACTOR SAFETY CIRCUITS
P. Phillips, B. V. Cake, and E. P. Fowler Nov. 1975 21 p refs
(AEEW-R-1031) Avail: ERDA Depository Libraries HC $3.50

In recent years the maximum level of induced interference current which can normally be expected in instrumentation systems has been found to be in the region of 100mA rms. However, in the course of investigating interference problems, abnormally high levels, of as much as 20A peak, have been found to originate from relay circuit interruption. A likely coupling mechanism for this source of interference is discussed and analyzed and it is concluded that proper suppression of relays is practical, safe, and beneficial. ERA

N76-33410# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
NOISE IN CAPACITANCE CANCELLATION BY NEGATIVE CAPACITANCE [IL RUMORE NELLA CANCELLAZIONE DI CAPACITA NEGATIVE]
V. DalBosco and G. V. Pallottino Nov. 1974 14 p refs In ITALIAN
(LPS-74-28) Avail: NTIS HC $3.50

The problem of compensating the input capacitance to a system by a negative capacitance using a positive feedback circuit is considered. The stability requirements were analyzed, and it is shown that an increase in the signal to noise ratio due mainly to the active amplifier needed in the positive feedback circuit corresponds to a reduction of the input capacitance. In the case of the detection of gravitational waves with n piezoelectric transducers in series, it is shown that the method is not useful.
ESA

N76-33411# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
NONLINEAR FILTER FOR THE REDUCTION OF WELL KNOWN PERTURBATIONS [FILTRO NONLINEARE PER LA RIDUZIONE DI DISTURBI DI FORMA NOTA]
U. Guadagno and G. V. Pallottino Feb. 1975 25 p refs In ITALIAN
(LPS-75-2) Avail: NTIS HC $3.50

A non-phase shifting nonlinear filter circuit was studied theoretically with a view to reducing exponential pulses of a specific type. It is shown that the filter may also be used for rectangular or sawtooth impulse noise with various repetition frequencies. The reasons for this versatility are to be found in its operation as noise limiter of the time derivative of the disturbing signal. Application to higher order derivatives is outlined. Experimental tests and performance tests show fair agreement with the theory. An integrated circuit version is described. ESA

N76-33412# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
ELECTRONIC EQUIVALENT CIRCUIT FOR GRAVITATIONAL ANTENNAS [CIRCUITO ELETTRONICO EQUIVALENTE PER ANTENNE GRAVITAZIONALI]
G. Pizzella Apr. 1975 24 p refs In ITALIAN
(LPS-75-15) Avail: NTIS HC $3.50

In order to investigate the reaction of an antenna to gravitational waves calibration impulses, or impulses due to mechanical, thermal, and electronic noise, it is convenient to model the antenna to an equivalent circuit. The gravitational antenna under study consisted of an elementary oscillator of two equal point masses bound to a return spring and a piezoelectric transducer working in open circuit. The effect of the piezoelectric transducer on the mechanical oscillator, the response of the antenna to a wave packet, and the sensitivity of the gravitational antenna are discussed. ESA

N76-33413# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
NONLINEAR FILTER FOR REDUCTION OF SWITCHING TRANSIENTS IN D-A CONVERTERS [FILTRO NONLINEARE PER LA RIDUZIONE DEI TRANSITORI DI COMMUTAZIONE NEI CONVERTITORI D-A]
U. Guadagno and G. V. Pallottino Apr. 1976 48 p refs In ITALIAN
(LPS-76-13) Avail: NTIS HC $4.00

Various possible circuits are presented showing how a nonlinear filter circuit may be used to reduce the switching transients (glitches) appearing in digital to analog converters. The advantages over the sample and hold circuits or other techniques are discussed. It is shown that it is always possible to compromise between the glitch reduction factor and the staircase signal distortion by simply modifying the voltages on the limiter circuit. ESA

N76-33414# Fondazione Ugo Bordoni, Rome (Italy).
STATUS OF LARGE SCALE INTEGRATION (LSI) [STATO DELLE TECNOLOGIE DI INTEGRAZIONE SU LARGA SCALA (LSI)]
Roberto Moretemurro and Francesco Villani 31 Jan. 1976 37 p refs In ITALIAN
Avail: NTIS HC $4.00

Large scale integration technologies are reviewed. The logic circuits are classified and their electric properties discussed, together with comparisons and future trends; similar information is given on semiconductor memories and microcomputers. A number of graphs and tables give further information. ESA

N76-33415# Fondazione Ugo Bordoni, Rome (Italy). Centro Onde Millimetriche.
SHUTTLE PULSE MEASUREMENT OF MODE COUPLING AND CONVERSION
P. Bernardi, Franco Bertolani, and Francesco Valdoni 29 Jul. 1975 20 p refs Submitted for publication
Avail: NTIS HC $3.50

The weak coupling between two guided modes, for which the usual TE10 setups cannot be directly used, was measured. The problem arises mainly in coupling between different waveguides and in overmoded waveguides. In both cases a representation by means of two coupled lines, described by a directional coupler scattering matrix, was chosen. In addition to the well-known resonant Klinger method, a new method, in the time domain, is suggested. This method makes use of a shuttle pulse test set and starts from the observation of the envelope of an output signal, which under suitable conditions shows zeros related to the coupling to be measured. Experimental results, with frequencies up to 90 GHz and couplings as low as -40 dB, confirm the accuracy and sensitivity of the new method.
Author (ESA)

N76-33416# RCA Corp., Burlington, Mass. Government Communications and Automated Systems Div.
PRODUCTION ENGINEERING MEASURES AUTOMATIC ASSEMBLY OF HYBRID INTEGRATED CIRCUITS Final Report, 6 Feb. 1974 - 13 Feb. 1976
D. R. Bokil 13 Feb. 1976 64 p refs
(Contract DAAB05-73-C-2039)
(AD-A022204; QPR-6; QPR-7) Avail: NTIS CSCL 09/5

Effort has been initiated to develop automatic techniques and equipment capable of mass production of thick film hybrid integrated circuits. The CMOS amplifier HDL Drawing Number 11722540, used in the XM734 multi-option fuze, has been selected as the assembly which will serve as the test vehicle. Deliverables include 150 Engineering Samples, including the Test Fixtures, substrate relayout drawing, approximately 25 Pre-Demo Samples and 3,000 Pilot Run Units. Approval of the relayout and the Pre-Demo samples is to be obtained prior to proceeding with the Demonstration. The Pilot Run units will be produced automatically per the Demonstration Plan, details of which were given in the Fourth Quarterly Progress Report. GRA

N76-33417# Raytheon Co., Waltham, Mass.
MANUFACTURING METHODS AND TECHNOLOGY MEASURE ARC PLASMA SPRAYED PHASE SHIFTER ELEMENTS Quarterly Progress Report, 1 Oct. - 31 Dec. 1975

H. J. VanHook, L. Lesensky, and H. Miller Jan. 1976 50 p (Contract DAAB07-75-C-0043)
(AD-A022174; S-1977; QPR-2) Avail: NTIS CSCL 09/5

The APS experiments have demonstrated that phase shifter samples can be obtained with properties which are substantially the same as those obtained at ECOM laboratories and within reach of the contract goals. In the preliminary runs, the functioning of the support equipment for the spraying operation (the furnace controls, the dielectric holder assembly and vertical was given motion equipment) had been unsatisfactory, and primary attention was given to these problems. A new furnace with a front opening door has been constructed, and controllers have been delivered. A modification of the sample holder used at ECOM has been built and is undergoing tests. Changes were made in the vertical motion equipment. A velocity sensor has also been installed and tested. GRA

N76-33418# University of Southern Calif., Los Angeles.
REDUCTION OF AC LOSSES IN HIGH TEMPERATURE SUPERCONDUCTORS Final Report
Y. B. Kim and K. S. Kim Apr. 1976 51 p refs Sponsored by EPRI
(PB-253624/1; EPRI-TD-136) Avail: NTIS HC $4.50 CSCL 09A

The feasibility of Nb3Ge being used as an ac superconducting power transmission cable mater was studied. The program was to measure ac loses in available samples of Nb3Ge and find under what conditions the loses can be reduced to 10 microwatts. sq cm at 15 K. Tasks of the program were: (1) make ac loss measurements on Nb3Ge; and (2) give metallurgical treatment to sample surfaces to reduce losses. Once a correlation is found between ac losses and the sample surface configurations, the surfaces have to be changed to reduce losses. The most effective way to accomplish annealing, polishing, etching, etc. is to prepare different surface configurations in the deposition process. GRA

N76-33419# Colorado Univ., Boulder. Electromagnetics Lab.
ELECTROMAGNETIC RESPONSE OF A CURRENT PULSE PROPAGATING ALONG A VERTICAL LIGHTNING CHANNEL
David C. Chang, Hussain A. Haddad, and S. W. Maley Oct. 1975 33 p refs
(Grant NOAA-04-4-022-12)
(PB-250712/7; NOAA-76020101; SR-14) Avail: NTIS HC $4.00 CSCL 20C

The current is assumed to travel along the channel with a constant velocity v. Given the current strength Io and the velocity v, the vertical electric field Ez observed on the earth ground could be calculated for any general time response function f(t). However, for a lightning channel, f(t) is assumed to vary as (exp(-p1t) where p1 and p2 determines the pulse width of the lightning. The kernel K in the frequency domain which is the electric vector potential pi sub z of a Hertzian dipole above a finitely conducting ground is known exactly in terms of Sommerfeld integrals, and approximately, in terms of incomplete Hankel functions. GRA

N76-33420# Michigan Univ., Ann Arbor. Electron Physics Lab.
MICROWAVE SOLID-STATE DEVICE AND CIRCUIT STUDIES Technical Report, 1 Sep. 1974 - 1 Mar. 1975
G. I. Haddad Griffiss AFB, N. Y. RADC Mar. 1976 133 p refs
(Contract F30602-74-C-0012; AF Proj. 5573)
(AD-A023933; RADC-TR-76-60; UMICH-012128-5-6) Avail: NTIS CSCL 09/1

This is the fifth and sixth quarterly report under subject contract whose objectives are to investigate theoretically and experimentally new solid state devices and circuits for microwave duplication generation and control. Tasks under this program are: avalanche diodes (IMPATT and TRAPATT), field-effect transistors, self mixing BARITT diodes and applications of BARITT type structures. Author (GRA)

N76-33421# Michigan Univ., Ann Arbor. Electron Physics Lab.
MICROWAVE SOLID-STATE DEVICE AND CIRCUIT STUDIES Technical Report, 1 Mar. - 1 Sep. 1975
N. A. Masnari Griffiss AFB, N. Y. RADC Mar. 1976 129 p refs
(Contract F30602-74-C-0012; AF Proj. 5573)
(AD-A023934; UMICH-012128-7-8; RADC-TR-76-61) Avail: NTIS CSCL 09/1

This is the seventh/eight quarterly progress report on subject contract whose objectives are to investigate theoretically and experimentally new solid-state phenomena and techniques having application to microwave generation, amplification and control. Tasks under this program are: Properites of IMPATT Diodes, Transverse Effects in IMPATT Devices, Pulsed IMPATT Diodes, Field-Effect Transistors, Experimental Field-Effect Transistor Investigations, IMPATT Diode Amplifiers, Properties of BARITT Devices and Microwave Applications of BARITT-Type Structures. Author (GRA)

N76-33422# National Bureau of Standards, Washington, D.C.
EVALUATION OF SELECTED CONNECTORS FOR ALUMINUM WIRE IN RESIDENTIAL STRUCTURES Final Report
Owen B. Laug Mar. 1976 38 p Sponsored in part by Consumer Product Safety Commission, Bethesda, Md.
(PB-254047/4; NBSIR-76-1039) Avail: NTIS HC $4.00 CSCL 09A

Systems of connecting aluminum wire for possible use in receptacle outlets and elsewhere in 15 and 20 ampere branch circuits in residences are discussed. The alternative systems are based on the principle of high deformation of the wire in the connection to achieve more permanent metal-to-metal fittings and/or wire splice devices of several designs. They involve either crimping the device around the wire or swaging the wire into the device with special tools. Based on tests, basic connection performance of several high-deformation connectors was established. The results indicate that certain designs of connectors operate with stability and without dangerously over-heating under accelerated laboratory tests. GRA

N76-33423# National Bureau of Standards, Washington, D.C. Electronic Technology Div.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: MICROELECTRONIC TEST PATTERN NBS-3 FOR EVALUATING THE RESISTIVITY-DOPANT DENSITY RELATIONSHIP OF SILICON
Martin G. Buehler Jun. 1976 60 p refs
(PB-254085/4; NBS-SP-400-22; LC-76-600032) Avail: NTIS HC $4.50 CSCL 09A

Test pattern NBS-3 is a microelectronic test vehicle designed by the National Bureau of Standards to evaluate the electronic materials used in discrete semiconductor devices and integrated circuits. Designed for fabrication on silicon wafers, the test pattern is an aid in better understanding integrated circuit fabrication technologies. The main pattern consists of four masks designated BASE, EMITTER, CONTACT, and METAL and contains 33 test structures such as sheet resistors, MOS capacitors, p-n junctions, bipolar and MOS transistors, and etch control and resolution structures. The pattern was designed primarily to aid in the evaluation of the relationship between resistivity and dopant density in both n- and p-type silicon. GRA

N76-33424# Lockheed Missiles and Space Co., Sunnyvale, Calif.
INVESTIGATION OF SEVERAL MEANS FOR EXTENSION OF SPEED RANGE AT CONSTANT HORSEPOWER OF ELECTRIC MOTORS Final Report, Jul. 1972 - May 1975
8 Jul. 1975 61 p refs
(Contract DAAK02-70-C-0299)
(AD-A024142; LMSC-D457677) Avail: NTIS CSCL 09/3

The report describes the investigation of electrical and mechanical shifts for an electric motor driven vehicle wheel. GRA

N76-33425# Michigan Univ., Ann Arbor. Electron Physics Lab.
PROPERTIES OF S-BAND TRAPATT DIODE OSCILLATORS Ph.D. Thesis
R. J. Trew Mar. 1976 265 p refs
(Contract F30602-74-C-0012; AF Proj. 5573)
(AD-A024432; UMICH-TR-134; RADC-TR-76-62) Avail: NTIS CSCL 09/5

The purpose of this investigation is to study theoretically

and experimentally the operation of TRAPATT mode (an acronym for trapped plasma avalanche triggered transit) oscillators. The solid-state device and microwave circuit as well as the interaction between them are considered in detail. A simplified computer model of a TRAPATT oscillator that considers the operation of the device from the terminal voltage-current waveforms has been developed. This model allows the investigation of arbitrary current waveforms and therefore can be used in the study of harmonic tuning effects and the requirements for high-efficiency operation. The simplified computer model is used to study the operation of the oscillator with many different terminal voltage-current waveforms. Waveforms containing up to ten harmonic frequencies are considered. By individually varying the amplitude and phase angles of each harmonic component the optimum tuning conditions for high-efficiency operation are obtained. It has been determined that the oscillator efficiency is primarily dependent upon the amplitude and phase angle of the fundamental signal and the phase angle of the second-harmonic component. The amplitude of the second harmonic and the amplitudes and phase angles of the third and higher harmonic components have a significant effect on oscillator frequency but only a minor effect on oscillator efficiency. It has also been determined, theoretically at least, that steady-state TRAPATT oscillations are possible with single-frequency operation. Author (GRA)

N76-33426# Northeastern Univ., Boston, Mass.
INSTRUMENTATION TO MEASURE OPERATION OF WINDOWLESS ANTENNA DURING ROCKET FLIGHT Final Report, 1 Oct. 1974 - 30 Sep. 1975
B. L. Cochrun, Raimundas Sukys, and Steven J. Goldberg 1 Dec. 1975 42 p refs
(Contract F19628-75-C-0031; AF Proj. 2153)
(AD-A024558; AFCRL-TR-75-0638) Avail: NTIS CSCL 09/6

This report describes instrumentation designed to measure the performance characteristics of base mounted antennas during a low altitude hypersonic flight. The parameters to be measured include reflection coefficients, interantenna coupling and electron density in the vicinity of the antennas. Standard PAM/FM/FM telemetry system is used for data transmission through a two antenna system mounted on the side of the nosecone. The telemetry antennas are also used as a supplementary diagnostics tool. The instrumentation was designed to be housed within a slender eight degree half-angle cone having a 22.9 centimeter diameter base. Author (GRA)

N76-33427# New Mexico State Univ., University Park. Physical Science Lab.
STRIPLINE BEACON AND TELEMETRY ANTENNA Technical Report, Feb. 1975 - Jan. 1976
Alexander Waterman and Dennis G. Henry Feb. 1976 27 p refs
(Contract F19628-75-C-0072; AF Proj. 7659)
(AD-A023688; PSL-PS00839; AFGL-TR-76-0066; SR-1; Rept-1) Avail: NTIS CSCL 09/5

The major development goal for this antenna was to add an S-band beacon array to an existing S-band telemetry antenna. The resultant antenna was to be flush mounted on a nine inch diameter vehicle. Author (GRA)

N76-33428# TRW, Inc., Lawndale, Calif. Semiconductor Div.
PRODUCTION ENGINEERING MEASURE FOR AN INTEGRATED CIRCUIT POWER AMPLIFIER 600-1000 MHz, FOR TACTICAL RADIO EQUIPMENT Quarterly Report, 1 Oct. - 31 Dec. 1975
Roger C. DeBloois Dec. 1975 30 p
(Contract DAAB05-72-C-5844; AF Proj. 2729)
(AD-A023938; QR-15) Avail: NTIS CSCL 09/5

This project is intended to provide for production engineering to manufacture an amplifier with the following characteristics: 30 watts output power; input impedance, 50 ohms; output impedance, 50 ohms; and frequency band, 600-1000 MHz. The amplifier will utilize the TRW MICroAMP(TM) broadband transistor which will be optimized as part of this project. Two of these devices will then be combined using 90 deg interdigitated couplers to produce a minimum of 30 watts of power. This amplifier will be adaptable for use as a building block for the fabrication of higher power systems. GRA

N76-33429# Naval Research Lab., Washington, D.C.
INITIAL TESTS OF INDUCED-CURRENT MICROCIRCUIT DAMAGE PRODUCED BY LIGHTNING
R. V. Anderson Apr. 1976 12 p ref
(NRL Proj. A02-15A; WF54585601)
(AD-A024016; NRL-MR-3268) Avail: NTIS CSCL 09/5

The vulnerability of electronics systems to damage and malfunction produced by lightning strikes is reviewed. Initial test data are shown in which this damage phenomenon is verified. The requirements and problems inherent in a magnetic-field measurement with which to accomplish an in situ measurement of lightning transients are discussed, the next series of measurements are described, and future directions for the research are indicated. Author GRA

N76-33430# Hughes Aircraft Co., Fullerton, Calif. Systems Effectiveness Dept.
LARGE PACKAGE HYBRID QUALIFICATION TESTS Final Technical Report, Feb. 1973 - Jun. 1974
R. E. Schafer, R. F. Yoder, and C. M. Ryerson Mar. 1976 111 p
(Contract F30602-73-C-0133; AF Proj. 5519)
(AD-A024218; RADC-TR-76-81) Avail: NTIS CSCL 09/5

This report presents the results of a study to determine the capability of large Hybrid packages to withstand the MIL-STD-883, Test Methods and Procedures for Microelectronics, environmental tests recommended for monolithic ICs, and to develop an updated prediction model for large Hybrid packages for inclusion in MIL-HDBK-217B. It was found that the ability to pass various environmental tests varied widely from package to package but generally, suitable stress levels (from MIL-STD-883) were found for each package type. An updated prediction model was developed. In so doing the complexity curves were modified, new examples given and the use of the heat sink temperature versus temperature factor curve clarified. Finally, a simplified prediction model was developed. Author (GRA)

N76-33431# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
SERIES INTERCONNECTION OF TRAPATT DEVICES ON INSULATING SUBSTRATES Final Report, 1 Dec. 1974 - 31 Nov. 1975
N. W. Cox, J. W. Amoss, G. N. Hill, and C. T. Rucker Jan. 1976 63 p refs
(Contract N00014-75-C-0401)
(AD-A024356) Avail: NTIS CSCL 09/5

This report describes the results of a study of the diode-circuit interactions in TRAPATT oscillators which use series connected diode chips to produce higher power outputs than could be obtained from a single chip. The effects of package parasitics on series interconnections of TRAPATT diodes mounted on diamond substrates have been studied via time domain computer simulations and experiments at frequencies from 2 to 9 GHz. Guidelines for the selection of package parasitics have been identified, and application of these guidelines to series connected diodes has resulted in combining efficiencies approaching 100% at frequencies up to 9 GHz. A multi-diode configuration with six chips mounted thermally in parallel and electrically in series on a diamond substrate yielded 35.5 watts at 7.5 GHz. Multi-chip diodes with two, three and four chips yielded 12, 14 and 21 watts respectively near 8.7 GHz. Author (GRA)

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N76-33432 Washington State Univ., Pullman.
APPLICATION OF OPERATIONAL METHODS TO LAMINAR INTERNAL TWO-PHASE FLOW Ph.D. Thesis
Omar Mohammed Ben-Zarty 1976 106 p
Avail: Univ. Microfilms Order No. 76-21367

Mathematical analysis such as Laplace and Hankel transform methods and complex integration was used to study incompressible laminar two-phase flow in channels with the assumption that the concentration of the dispersed phase is uniform throughout the channel. Time-dependent Couette flow, time-dependent channel flow, and steady state channel flow were investigated. Dissert. Abstr.

N76-33433*# Transemantics, Inc., Washington, D.C.
PECULIARITIES OF THE EFFECT OF A TRANSVERSE MAGNETIC FIELD ON TURBULENT FLOWS OF LIQUID METAL AT VARIOUS REYNOLDS NUMBERS
G. G. Branover and O. A. Liyelausis NASA Aug. 1976 9 p refs Transl. into ENGLISH from Problems of Magnetohydronamics (USSR), vol. 3, 1963 p 59-63
(Contract NASw-2792)
(NASA-TT-F-17191) Avail: NTIS HC $3.50 CSCL 20D

The influence of a transverse magnetic field on the drag coefficient in the turbulent flow of a liquid metal for various values of the Reynolds number between 1400 and 3500 was investigated experimentally, using a nonconducting 0.1 x 4.0 cm slot-shaped channel. The effects of the transverse magnetic field on the flow are explained by the degree of turbulence. It is concluded that in engineering calculation the effect of the transverse magnetic field must be taken into account for values of (M square/Re) greater than 0.001 to 0.01. Author

N76-33434*# Vought Corp., Dallas, Tex. Systems Div.
DEVELOPMENT OF AN INFLATABLE RADIATOR SYSTEM Final Report
J. W. Leach 28 May 1976 340 p refs
(Contract NAS9-13346)
(NASA-CR-150996; Rept-2-53002/6R-51338) Avail: NTIS HC $10.00 CSCL 20M

Conceptual designs of an inflatable radiator system developed for supplying short duration supplementary cooling of space vehicles are described along with parametric trade studies, materials evaluation/selection studies, thermal and structural analyses, and numerous element tests. Fabrication techniques developed in constructing the engineering models and performance data from the model thermal vacuum tests are included. Application of these data to refining the designs of the flight articles and to constructing a full scale prototype radiator is discussed. Author

N76-33435*# Kanner (Leo) Associates, Redwood City, Calif.
PROBLEM OF REDUCING HYDRODYNAMIC DRAG
V. I. Merkulov Washington NASA Sep. 1976 16 p Transl. into ENGLISH from Visn. Akad. Nauk Ukr. RSR (USSR), v. 34, Jan. 1970 p 52-59
(Contract NASw-2790)
(NASA-TT-F-17188) Avail: NTIS HC $3.50 CSCL 20D

A mathematical analysis of the relationship of hydrodynamic drag to planar and turbulent flow in a viscous fluid is presented. Based upon observations of the movements of dolphin and tuna, the Grey and d'Alembert-Stokes paradoxes are considered in a new set of vector equations. The effects of limiting conditions and boundary layer behavior are reviewed relative to streaming waves. Periodicity of the boundary layer is related to periodic boundary conditions. The relationship of streaming waves on elastic properties is also discussed. Author

N76-33436*# Scientific Translation Service, Santa Barbara, Calif.
EXPERIMENTAL INVESTIGATIONS INVOLVING ANNULAR CHANNELS WITH AN AXIAL FLOW Ph.D. Thesis
Burkhard Stampa Washington NASA Oct. 1976 158 p Transl. into ENGLISH of "Experimentelle Untersuchungen an Axialdurchstroemten Ringspalten" Braunschweig Tech. Univ., 1971 p 1-157
(Contract NASw-2791)
(NASA-TT-F-17213) Avail: NTIS HC $6.75 CSCL 20D

Annular channels of constant width are considered. It is assumed that the internal wall can perform rotational motions. The flow studies are confined to incompressible media. The results are reviewed, giving attention to laminar and turbulent flow with and without wall motion. Concentric and eccentric annular channels are considered. A method is developed for the calculation of the flow volume through the channel. This method provides a flow relation for the entire channel on the basis of the conditions at the various positions of the channels. Experimental investigations regarding the channel flow were conducted. A graphic and a computational procedure for the determination of the flow volume is discussed. Author

N76-33437*# Kanner (Leo) Associates, Redwood City, Calif.
HYDRODYNAMICS IN WEAK GRAVITATIONAL FIELDS: PLANE OSCILLATION PROBLEMS OF AN IDEAL LIQUID IN A VESSEL
N. D. Kopachevskiy Washington NASA Sep. 1976 33 p refs Transl. into ENGLISH from Zh. Vychislitelnoy Mat. Mat. Fiz. (Kharkov), v. 13, no. 4, Jul.-Aug. 1973 p 952-970
(Contract NASw-2790)
(NASA-TT-F-17216) Avail: NTIS HC $4.00 CSCL 20D

Plane problems of small natural oscillations of an ideal liquid in symmetrical containers under the action of capillary forces and gravitational forces are considered. The results of calculations by computer are presented in the form of tables, graphs, and asymptotic formulas. Author

N76-33438*# Kanner (Leo) Associates, Redwood City, Calif.
THE BATCHELOR THEOREM ON THE CIRCULATION REGION
E. G. Shifrin Washington NASA Sep. 1976 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. Zhidkosti i Gaza (Moscow), no. 1, Jan. - Feb. 1976 p 140-143
(NASA-TT-F-17221) Avail: NTIS HC $3.50 CSCL 20D

The Batchelor theorem is used to investigate the relation between the temperature and the stream functions of an ideal fluid in the region with closed streamlines. Taking account of the dependence of viscosity on temperature for the distributions of vorticity and temperature, a system of equations is obtained indicating that the constant vorticity in the circulation region is possible only in the exceptional case of quasirigid rotation. Author

N76-33439*# Kanner (Leo) Associates, Redwood City, Calif.
MOMENTUM AND HEAT TRANSFER IN TURBULENT WAKES BEHIND BODIES OF REVOLUTION
H. Reichardt and R. Ermshaus Washington NASA Oct. 1976 30 p refs Transl. into ENGLISH from Intern. J. Heat Mass Transfer (England), v. 5, 1962 p 251-265
(Contract NASw-2790)
(NASA-TT-F-17250) Avail: NTIS HC $4.00 CSCL 20D

The development of the width of a turbulent axisymmetric wake depends on the shape of the body of revolution generating the wake. Within certain limits, the shape of the momentum loss distribution is also influenced by the shape of the body. Behind slender bodies of revolution bell shaped distributions of velocity and temperature are found. The coefficient of heat exchange is slightly greater than the coefficient of momentum exchange. The outer potential flow restricts the turbulent exchange in axisymmetric wakes more than in two dimensional wakes and in jets. Author

N76-33440*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STEADY-STATE HEAT TRANSFER IN TRANSVERSELY HEATED POROUS MEDIA WITH APPLICATION TO FOCUSED SOLAR ENERGY COLLECTORS
Lester D. Nichols Washington Oct. 1976 46 p refs
(NASA-TN-D-8310; E-8739) Avail: NTIS HC $4.00 CSCL 20D

A fluid flowing in a porous medium heated transversely to the fluid flow is considered. This configuration is applicable to a focused solar energy collector for use in an electric power generating system. A fluidized bed can be regarded as a porous medium with special properties. The solutions presented are valid for describing the effectiveness of such a fluidized bed for collecting concentrated solar energy to heat the working fluid of a heat engine. Results indicate the advantage of high thermal conductivity in the transverse direction and high operating temperature of the porous medium. Author

N76-33441*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

TIME-ASYMPTOTIC SOLUTIONS OF THE NAVIER-STOKES EQUATION FOR FREE SHEAR FLOWS USING AN ALTERNATING-DIRECTION IMPLICIT METHOD

David H. Rudy and Dana J. Morris Washington Oct. 1976 39 p refs

(NASA-TN-D-8217; L-10669) Avail: NTIS HC $4.00 CSCL 20D

An uncoupled time asymptotic alternating direction implicit method for solving the Navier-Stokes equations was tested on two laminar parallel mixing flows. A constant total temperature was assumed in order to eliminate the need to solve the full energy equation; consequently, static temperature was evaluated by using algebraic relationship. For the mixing of two supersonic streams at a Reynolds number of 1,000, convergent solutions were obtained for a time step 5 times the maximum allowable size for an explicit method. The solution diverged for a time step 10 times the explicit limit. Improved convergence was obtained when upwind differencing was used for convective terms. Larger time steps were not possible with either upwind differencing or the diagonally dominant scheme. Artificial viscosity was added to the continuity equation in order to eliminate divergence for the mixing of a subsonic stream with a supersonic stream at a Reynolds number of 1,000. Author

N76-33442# Air Force Systems Command, Wright-Patterson AFB, Ohio.

DYNAMICS OF A CONTINUUM (SELECTED ARTICLES)

4 Dec. 1975 17 p refs Transl. into ENGLISH from Dinam. Sploshnoi Sredy, (USSR), no. 7, 1971 p 125-129, 172-177 (AD-A019169; FTD-ID(RS)I-2303-75) Avail: NTIS CSCL 20/4

Contents: Method of determining the density of high speed gas streams; Scattering of natural products of detonation from the lateral surface of a charge. GRA

N76-33443# Oak Ridge National Lab., Tenn.

MATERIAL TRANSPORT THROUGH POROUS MEDIA: A FINITE-ELEMENT GALERKIN MODEL

J. O. Duguid and M. Reeves Mar. 1976 201 p refs

(Contract W-7405-eng-26)

(ORNL-4928) Avail: NTIS HC $8.75

A two-dimensional transient model for flow of a dissolved constituent through porous media was developed. Mechanisms for advective transport, hydrodynamic dispersion, chemical absorption, and radioactive decay are included. Implementations of quadrilateral finite elements, bilinear spatial interpolation, and Gaussian elimination are used. The programming language FORTRAN IV is used. In addition to a description of the mathematical formulation, the numerical treatment and the computer implementation results of two computer simulations are included. One is a comparison with a well-known analytical treatment and is intended as a partial validation. The other simulation, a seepage-pond problem, is a more realistic demonstration of the capabilities of the computer model. Complete listings of input and output are given so that this simulation may be used for checkout purposes. A comprehensive description of the material-transport computer model is given. NSA

N76-33444# Dornier-System G.m.b.H., Friedrichshafen (West Germany).

THEORY OF ACCOMMODATION IN HYPERSONIC FLOWS

Wolfgang J. C. Mueller and Heinz Lang Bonn Bundesmin. fuer Forsch. u. Technol. Mar. 1976 291 p refs In GERMAN; ENGLISH summary Prepared jointly with Max-Planck-Inst. fuer Stroemungsforsch.

(Contracts BMFT-WRT-2073; GfW-RV-11-V-76/73)

(BMFT-FB-W-76-01) Avail: NTIS HC $9.25

The slip-flow boundary conditions for mixtures of monatomic gases were derived for small deviations from equilibrium within the Knudsen layer and are expressed in terms of first and second order accommodation coefficients. The effects of velocity slip, temperature slip, thermal creep, and diffusion slip are treated, as well as the influence of surface anisotropy (second thermal creep flow, second diffusion slip flow). The second order slip velocity was derived for a simple gas. Several models for the scattering kernel were investigated and the influence of their parameters on the accommodation coefficients and the boundary conditions was calculated. Possibilities of extending the present theory to regions of larger deviations from thermal equilibrium and methods of evaluating the accommodation coefficients are discussed. Author (ESA)

N76-33445# Oxford Univ. (England). Engineering Lab.

THE MEASUREMENT OF HEAT TRANSFER RATES TO FILM COOLED EXTERNAL SURFACES AND THE INTERNAL PASSAGES OF TURBOMACHINE COMPONENTS UNDER TRANSIENT CONDITIONS USING THIN FILM GAUGES

D. L. Schultz, T. V. Jones, M. L. G. Oldfield, R. W. Ainsworth, and L. A. Daniels Apr. 1976 48 p refs

(OUEL-1152/76) Avail: NTIS HC $4.00

The use of thin film gages for measuring heat transfer rate of turbomachine components under transient conditions is dealt with, and the cost benefits to be obtained from transient techniques in general are considered. A cascade facility capable of a wide range of operating conditions was developed; it can achieve more than full scale engine Reynolds numbers at the correct exit Mach number and gas-to-wall temperature ratio on rotor blades and nozzle guide vanes. Blades instrumented for heat transfer rate and pressure distribution were tested and conventional surface (oil drop) and flow field (shadow, schlieren) visualization used to prove the quality of the flow. A second free piston compressor was developed specifically for research on internal blade cooling systems and some results from this facility are reported. ESA

N76-33446# Oxford Univ. (England). Engineering Lab.

AN APPARATUS FOR VISUALIZING CONTINUOUS FLOW BOILING IN LIQUID HELIUM I

W. B. Bald, H. Zust, and W. G. Wooster Apr. 1976 35 p refs Sponsored by Sci. Res. Council

(OUEL-1154/76) Avail: NTIS HC $4.00

The construction of an apparatus used to investigate steady state flow boiling of liquid helium I in vertical channels is described. The overall flow system and the basic vacuum dewar are designed to carry out a wide range of flow boiling experiments, whereas the specific test section described is intended to observe continuous flow boiling in vertical tubes. This allows accurate flow pattern charts to be constructed at different liquid/vapor voidage fractions. ESA

N76-33447# ARO, Inc., Arnold Air Force Station, Tenn.

THE AEDC THREE-DIMENSIONAL, POTENTIAL FLOW COMPUTER PROGRAM. VOLUME 1: METHOD AND COMPUTER PROGRAM Final Report, Nov. 1971 - Nov. 1974

Donald C. Todd AEDC Feb. 1976 108 p 2 Vol.

(ARO Proj. PW5146; ARO Proj. PW5246)

(AD-A021693; ARO-PWT-TR-75-7-Vol-1;

AEDC-TR-75-75-Vol-1) Avail: NTIS CSCL 20/4

A complete description of a computer analysis of the potential subsonic flow about complex three-dimensional bodies is presented. The linear, partial differential equation for the compressible velocity gradient is solved for cases where the local Mach number everywhere in the flow field is less than one. The compressible flow equation is transformed, using Goethert similarity parameter, into the equivalent incompressible form represented by Laplace's equation. The solution to the equation is accomplished by representing the body (or model) by a finite number of elements (or singularities). The singularities may be made up of either vortices or sources. The two volumes included in the report give the description of the computer program which is entitled the AEDC Potential Flow Program (PFP) and the computer analysis of several complex bodies. Volume 1 includes a theoretical development of the equations that lead to the set that are programmed in the PFP. A complete description of the computer program is given along with sample input and output from the program. GRA

N76-33448# ARO, Inc., Arnold Air Force Station, Tenn.

THE AEDC THREE-DIMENSIONAL, POTENTIAL FLOW COMPUTER PROGRAM. VOLUME 2: MATHEMATICAL MODELING, APPLICATION, AND VERIFICATION Final Report, Nov. 1971 - Nov. 1974

Richard L. Palko AEDC Feb. 1976 55 p refs 2 Vol.

(ARO Proj. 5146; ARO Proj. 5246)

(AD-A021694; ARO-PWT-TR-75-7-Vol-2;

AEDC-TR-75-75-Vol-2) Avail: NTIS CSCL 20/4

Volume 2 includes a discussion concerning the modeling techniques that can be used to represent a wide class of three-dimensional bodies and gives the results of the flow field computed about these bodies using the PFP. Comparisons of some of the theoretical results are made with wind tunnel experimental data. GRA

N76-33449# Naval Ship Research and Development Center, Bethesda, Md.

PRESSURE FLUCTUATIONS IN THE REGIONS OF FLOW TRANSITION

T. T. Huang and D. E. Hannan Dec. 1975 56 p refs

(ZR0230101)

(AD-A022935; DTNSRDC-4723) Avail: NTIS CSCL 20/4

Measurements of wall-pressure fluctuations during natural flow transition and following laminar separation have been made for two forebodies of revolution. The data indicate enormous pressure fluctuations in regions of transition, which in turn have profound implications relative to cavitation-inception scaling and other naval applications related to the transition phenomenon. The Smith amplification method is extensively used to correlate the measured data with semiempirical calculations. Striking success with this correlation is found. The use of trip wires to reduce pressure fluctuations in regions of flow transition is also discussed. GRA

N76-33450# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

AN EXPERIMENTAL INVESTIGATION OF PRESSURE OSCILLATIONS IN TWO-DIMENSIONAL OPEN CAVITIES M.S. Thesis

Michael F. Marquardt Dec. 1975 68 p refs

(AD-A023355; GAE/AE/75D-14) Avail: NTIS CSCL 20/4

An experimental study was conducted to determine the characteristics of the pressure oscillations in a small two-dimensional cavity exposed to tangential air flow. Various cavity configuration changes, involving the shape of the leading and trailing edge, were investigated to determine the relative capability to suppress the resonance in the cavity response. Five airflow Mach numbers (0.5, 0.6, 1.0, 1.3, 1.5) were used to investigate the Mach-response relationship. Two cavity lengths were considered (2 and 4 1/4 inches). The depth of the cavities was kept constant at one inch. Fluctuating pressure recordings and schlieren photographs were made of each test. GRA

N76-33451# Naval Ship Research and Development Center, Bethesda, Md.

EFFECT OF LOCAL SURFACE ROUGHNESS ON TURBULENT BOUNDARY LAYER-WALL PRESSURE SPECTRA AND TRANSITION BURST ONSET

Edmund J. OKeefe, Mario J. Casarella, and Frederick C. DeMetz Dec. 1975 68 p refs

(SF43452702)

(AD-A022996; DTNSRDC-4702) Avail: NTIS CSCL 20/4

An experimental study of boundary-layer velocity profiles and turbulent wall-pressure spectra on a smooth flat plate with varying localized roughness conditions is reported. The sandpaper surface roughness ranged from a smooth wall to the fully rough condition. Transition and turbulent flow data are consistent with those in the published literature. In addition, new data have been obtained for the wall-pressure spectra for a complete range of roughness conditions. Formulas for estimating the increase in wall spectra levels due to varying surface-roughness conditions are presented. GRA

N76-33452# Naval Surface Weapons Center, White Oak, Md.

PREDICTION OF VERTICAL WATER-ENTRY FORCES ON OGIVES FROM CONE DATA Interim Report

J. L. Baldwin 15 Aug. 1975 52 p refs

(AD-A023616; NSWC/WOL/TR-75-100) Avail: NTIS CSCL 20/4

An empirical method of predicting the drag coefficient for vertical water entry of pointed shapes is presented. The drag coefficient versus depth function is generated from experimental results of the vertical entry of cones of various angles. Comparison with experimental results shows that the predicted values are accurate to within + or - 25 percent. A computer program for predicting the water-entry drag coefficient of many shapes is included. Author (GRA)

N76-33453# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

EFFECT OF SHOCK IMPINGEMENT ON HEAT TRANSFER. PART 4: A FURTHER BOUNDARY LAYER/SHOCK WAVE INTERACTIONS ON CURVED WALLS Final Scientific Report, 1 May 1971 - 31 Dec. 1975

David S. Dolling and Jean J. Ginoux Jan. 1976 82 p refs

(Grant AF-AFOSR-2147-71; AF Proj. 9781)

(AD-A023088; VKI-TN-115-Pt-4; AFOSR-76-0331TR) Avail: NTIS CSCL 20/4

A theoretical parametric study has been made of adiabatic, laminar boundary layer/shock wave interactions on flat plate/convex ramp configurations. The ramp takes the form of a circular arc. This was done by using a computer program based on the integral method of Lees and Reeves recently successfully modified to include effects of streamwise ramp curvature. Primarily, the effects of different ramp radii on the overall interaction pressure distribution and other salient interaction parameters have been studied. As a further check on the theoretical model, which has already been successfully compared with experimental results at low Mach numbers, static pressure distributions throughout adiabatic laminar interactions have been measured at a free stream Mach number of 5.55. Compared to the present measured pressure distributions the theoretical model gives a satisfactory comparison downstream of the corner but overpredicts the extent of upstream influence. Furthermore, experimental pressure distributions are presented of adiabatic transitional interactions generated on convex ramp models. Author (GRA)

N76-33454# Wisconsin Univ., Madison. Mathematics Research Center.

SWIRLING FLOW: A SURVEY

J. B. McLeod Jan. 1976 20 p refs

(Contract DAAG29-75-C-0024)

(AD-A022741; MRC-TSR-1473) Avail: NTIS CSCL 20/4

The paper surveys the analytical work on existence and behavior of solutions for the von Karman swirling flow equations. The boundary conditions depend on whether the independent variable lies in a finite or semi-infinite range. GRA

N76-33455# Tel-Aviv Univ. (Israel). Dept. of Applied Mathematics.

FINITE ELEMENTS FOR FLUID DYNAMICS Interim Report, Jul. 1974 - Jul. 1975

Nima Geffen Jul. 1975 48 p refs

(Grant AF-AFOSR-2561-73; AF Proj. 9781)

(AD-A023149; AFOSR-76-0378TR) Avail: NTIS CSCL 20/4

Quasi linear systems of partial differential equations with initial and boundary values are treated via an equivalent variational formulation. Finite elements with linear and bi-linear approximations are described and calculations done for heat transfer, wave propagation and transonic flow problems. A variational principle for three-dimensional systems with arbitrary constraints in which the vector Lagrange multiplier has a clear physical meaning is proposed. Author (GRA)

N76-33456# RAND Corp., Santa Monica, Calif.

ON THE FLUID MECHANICS AND HEAT TRANSFER OF LIQUEFIED NATURAL GAS SPILLS

W. S. King Jun. 1975 20 p refs

(AD-A022226; P-5396) Avail: NTIS CSCL 13/2

A mathematical model of the interaction between an evaporating liquefied natural gas spill on the ocean and the ambient water is presented. It is shown that the effect of mass addition that was neglected in previous analysis on the fluid mechanics and heat transfer of the spill is significant. A new mathematical model of the spill is proposed, approximations are discussed, and solution techniques are indicated. GRA

N76-33457# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

SETTLING PROFILES OF PARTICLES IN FLUIDS Final Report, 1 Jan. - 1 Jul. 1975

P. W. Centers, J. B. Schrand, and R. E. Centers Feb. 1976 31 p refs

(AF Proj. 3048)
(AD-A022211; AFAPL-TR-75-77) Avail: NTIS CSCL 11/8

Settling profiles of polydispersed systems of particles in fluids are generated by combining distribution and settling functions. A computer program is employed for plotter presentation of normal and log normal distributions of anti-foamants, wear metals and oxides settling in synthetic lubricants under Stokesian conditions both as functions of time and temperature. Methods are examined for extension of the procedure to other systems. Generated settling profiles are useful in the prediction of storage characteristics of polydispersed systems and to establish effective sampling technique for the analysis of those systems. GRA

N76-33458# Naval Ship Research and Development Center, Annapolis, Md. Propulsion and Auxiliary Systems Dept.
MARINE FOULING OF TITANIUM HEAT EXCHANGERS
Wayne L. Adamson Mar. 1976 30 p refs
(AD-A022207; PAS-75-29) Avail: NTIS CSCL 13/1

A series of marine fouling experiments was conducted at Freeport, Texas, on two single-pass titanium heat exchangers. The exchangers, which were constructed with commercially pure titanium tubes (5/8-inch (1.59-centimeter)) outside diameter by 30-inch (76.3-centimeter length) and 6Al-4V alloy tube sheets and headers, were operated on natural seawater. One of the exchangers was fed electrolytically chlorinated seawater, while the other was run with untreated seawater feed. Velocity and chlorination levels were varied to determine the effect of these two variables on fouling of the titanium surfaces. Operating conditions similar to those that might be expected in shipboard heat exchanger/condenser usage were modeled. GRA

N76-33459# Cincinnati Univ., Ohio. Dept. of Chemical and Nuclear Engineering.
EVALUATION OF PRESSURE DROP ACROSS AREA CHANGES DURING BLOWDOWN Quarterly Report, 30 Jun. - 30 Sep. 1975
J. Weisman Apr. 1976 16 p refs
(Contract AT(49-24)-0179)
(PB-251743/1; NUREG-0047-2) Avail: NTIS HC $3.50 CSCL 18I

Blowdown experiments were conducted with Freon 113 as the test fluid. Procurement of the instrumentation and the data acquisition equipment is discussed along with checkout runs, calibration of the void sensor devices used, and selection of computational models for the analysis of the transient pressure drop at abrupt area changes. Author

N76-33460# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
HEAT TRANSFER AND FLOW OF HELIUM IN CHANNELS: PRACTICAL LIMITS FOR APPLICATIONS IN SUPERCONDUCTIVITY
M. C. Jones and W. W. Johnson Jan. 1976 48 p refs
(PB-250725/9; NBS-TN-675) Avail: NTIS HC $4.00 CSCL 20M

Heat transfer and fluid mechanics of helium flowing in channels are reviewed. Emphasis is placed on observed or anticipated limits of operation which might be expected to apply in applications of superconductivity. Topics included are: the high heat flux degradation of heat transfer and possible effects of buoyancy forces in supercritical helium; transition to film boiling in subcritical helium; limiting heat currents in helium 11; and the possibility of oscillations in forced flow helium systems. GRA

N76-33461# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.
NONTANGENTIAL INJECTION OF SINGLE AND TWO-PHASE JETS INTO SUBSONIC FLOW
George Rudinger Jan. 1976 12 p refs Prepared by Textron Bell Aerospace Co., Buffalo
(Contract N00014-75-C-1143; Proj. SQUID; NR Proj. 098-038)
(AD-A022163; SQUID-TR-BA-1-PU) Avail: NTIS CSCL 20/4

The large amount of information available on the penetration of pure gas jets into a cross flow makes it attractive to represent a gas-particle jet by an equivalent gas jet. Perfect equivalence required that the two jets have the same average density, mass flow and momentum flux. It was shown that for moderate particle concentrations, exact equivalence is possible only if the particles are in velocity equilibrium with the gas. Experiments were performed with 33 micrometers glass beads carried by a nitrogen jet injected into a cross stream of air. Jet and stream velocities ranged over several tens meters per second, and the particle flow rate varied between 2.3 and 25 times that of the carrier gas. Particle velocities were obtained with a laser-Doppler system and found to be between 40 and 60% of the velocity of the carrier gas. The concept of an equivalent gas jet therefore was expected to apply. GRA

N76-33462# Purdue Univ., Lafayette, Ind. Dept. of Nuclear and Chemical Engineering.
TEMPERATURE AND EDDY DIFFUSIVITY IN FULLY TURBULENT PIPE FLOW M.S. Thesis
Gail Ann Klein Aug. 1974 97 p refs
(Grant NSF GK-35776)
(PB-253278/6) Avail: NTIS HC $5.00 CSCL 20D

A model consistent with the energy equation and a number of conditions is proposed to describe mean temperature and eddy diffusivity distributions for liquid metals in fully developed pipe flow. Functions, representing the eddy diffusivity of heat in the low and high Reynolds number ranges, respectivity, were generated, which, upon substitution into the turbulent energy equation, provide temperature profile data which are in reasonably good agreement with published experimental values. GRA

N76-33463# Wyle Labs., Inc., El Segundo, Calif.
FLOW RESISTIVITY AND POROSITY TESTING OF SURFACE MATERIALS
Ron Brown, Mark C. Lee, and Louis C. Sutherland May 1975 39 p refs
(Contract EPA-68-01-2449)
(PB-253299/2; WRC-75-8) Avail: NTIS HC $4.00 CSCL 13C

Flow resistivity and porosity measurements have been performed on a variety of ground surface materials using a forced airflow apparatus and a microglass-bead-calibrated porosity instrument. It is found that the flow resistivity ranges from over 1 million cgs rayls/cm for concrete down to less than 100 for sand and gravel. The porosity ranges from 0.4 for dry soil to less than 0.01 for concrete. Based on these measurements, the normal absorption coefficient for a 200 Hz acoustic wave is less than 0.2 for all of the materials tested except gravel, the value of which is approximately 0.4. For standard asphalt utilized for surface pavement, for instance, the estimated normal absorption coefficient is found to be less than 0.01. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N76-33464*# Computer Sciences Corp., Huntsville, Ala.
DIGITAL COMPUTER PROCESSING OF PEACH ORCHARD MULTISPECTRAL AERIAL PHOTOGRAPHY
Robert J. Atkinson Oct. 1976 103 p refs
(Contract NAS8-21805)
(NASA-CR-149998) Avail: NTIS HC $5.50 CSCL 14E

Several methods of analysis using digital computers applicable to digitized multispectral aerial photography, are described, with particular application to peach orchard test sites. This effort was stimulated by the recent premature death of peach trees in the Southeastern United States. The techniques discussed are: (1) correction of intensity variations by digital filtering, (2) automatic detection and enumeration of trees in five size categories, (3) determination of unhealthy foliage by infrared reflectances, and (4) four band multispectral classification into healthy and declining categories. Author

N76-33465*# Westinghouse Defense and Electronic Systems Center, Baltimore, Md.
BREADBOARD LINEAR ARRAY SCAN IMAGER USING LSI SOLID-STATE TECHNOLOGY Final Report, Jul. 1972 - May 1976
Richard A. Tracy, John A. Brennan, David G. Frankel, and Robert E. Noll 31 May 1976 191 p refs
(Contract NAS5-21806)
(NASA-CR-144814) Avail: NTIS HC $7.50 CSCL 14B

The performance of large scale integration photodiode arrays in a linear array scan (pushbroom) breadboard was evaluated for application to multispectral remote sensing of the earth's resources. The technical approach, implementation, and test results of the program are described. Several self scanned linear array visible photodetector focal plane arrays were fabricated and evaluated in an optical bench configuration. A 1728-detector array operating in four bands (0.5 - 1.1 micrometer) was evaluated for noise, spectral response, dynamic range, crosstalk, MTF, noise equivalent irradiance, linearity, and image quality. Other results include image artifact data, temporal characteristics, radiometric accuracy, calibration experience, chip alignment, and array fabrication experience. Special studies and experimentation were included in long array fabrication and real-time image processing for low-cost ground stations, including the use of computer image processing. High quality images were produced and all objectives of the program were attained. Author

N76-33466# Rockwell International Corp., Anaheim, Calif. Autonetics Group.
APPLICATION OF THE AUTONETICS BIAXIAL TILTMETER TO ERROR CORRECTION IN RADAR AND OPTICAL TRACKER AXES
Harrell D. Hairfield and Craig G. Kirkpatrick 13 Sep. 1976 25 p refs Presented at Military Electronics Defence Expo '76, Wiesbaden (W. Germany), 6-8 Oct. 1976
(X76-992/201) Avail: NTIS HC $3.50

A tilt sensor, originally developed to aid in the correction of alignment on the Minuteman Guidance System, was used to provide data for error correction in radar antenna axes. The sensor response to tilt and horizontal motion is presented. A typical set of equations is derived for correction of both pointing error and the error due to offsetting the tiltmeter from the axis of rotation. The sensor can be permanently mounted, since it possesses Minuteman reliability and ruggedness. Author

N76-33467# Rockwell International Corp., Anaheim, Calif. Autonetics Group.
ANALYSIS TECHNIQUE FOR CALIBRATING ANGULAR-MEASURING DEVICES
R. L. Hall Jun. 1976 7 p Presented to the AIAA Guidance and Control Conf., San Diego, Calif., 16-18 Aug. 1975 Sponsored by USAF
(X76-752/201) Avail: NTIS HC $3.50

The analytical process described allows the calibration of angular measuring devices to very high accuracy. No prior knowledge of the error in the device is required and the devices may or may not be identical devices. The types of devices which can be calibrated to high accuracies and the configuration for calibrating is explored. The process was used to calibrate an angular-positioning table and angle resolver to 0.1 arc second. A dual inductosyn system for axis angle readout was also calibrated. Data acquired from these calibrations are presented. Author

N76-33468# Japan Broadcasting Corp., Tokyo.
SATICON AND ITS APPLICATION TO SMALL-SIZED COLOR TV CAMERAS
Teruo Ninomiya, Kotaro Wakui, Naohiro Goto, and Keiichi Shidara Mar. 1976 41 p refs
(TM-25) Avail: NTIS HC $4.00

The SATICON, a photoconductive, image pickup tube which employs a heterojunction target between tin oxide and selenium doped with arsenic and tellurium, i.e., a glass semiconductor target is described. The SATICON has high resolution, response characteristics comparable to those of a conventional 1 inch pickup tube, and has excellent features as an image pickup tube for use in color cameras. Application of the SATICON to small color TV cameras for broadcasting and industrial uses is discussed. J.M.S.

N76-33469*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
VELOCITY MEASUREMENT SYSTEM Patent Application
Walter Haeussermann, inventor (to NASA) Filed 6 Oct. 1976 15 p
(NASA-Case-MFS-23363-1; US-Patent-Appl-SN-730046) Avail: NTIS HC $3.50 CSCL 14B

A velocity sensor for sensing the speed of a moving conductive body employing an E-shaped magnetic core with a pair of spaced Hall effect devices positioned on the end of the central core is described. The ends of all cores are adjacent to the path of the moving conductive body. The difference in output voltage registered by the two Hall effect devices is indicative of the speed of the conductive body. NASA

N76-33470*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ZERO GRAVITY SEPARATOR Patent Application
Franklin W. Booth, inventor (to NASA) Filed 8 Oct. 1976 19 p
(NASA-Case-LAR-10344-1; US-Patent-Appl-SN-730779) Avail: NTIS HC $3.50 CSCL 14B

An electrostatic precipitator efficient in removing ultra-small (less than 2 microns in diameter) particles and liquid aerosols from a gas stream is described. Precipitates are collected by, and washed through a liquid-saturated, porous portion of the precipitator wall to prevent re-entrainment of the precipitates in the gas stream. NASA

N76-33471*# Illinois Univ., Urbana. Dept. of Computer Science.
SPECIFICATION AND PRELIMINARY DESIGN OF AN ARRAY PROCESSOR Final Report
D. L. Slotnick and Marvin L. Graham Oct. 1975 296 p refs
(Contract NAS5-23334)
(NASA-CR-144810) Avail: NTIS HC $9.25 CSCL 14B

The design of a computer suited to the class of problems typified by the general circulation of the atmosphere was investigated. A fundamental goal was that the resulting machine should have roughly 100 times the computing capability of an IBM 360/95 computer. A second requirement was that the machine should be programmable in a higher level language similar to FORTRAN. Moreover, the new machine would have to be compatible with the IBM 360/95 since the IBM machine would continue to be used for pre- and post-processing. A third constraint was that the cost of the new machine was to be significantly less than that of other extant machines of similar computing capability, such as the ILLIAC IV and CDC STAR. A final constraint was that it should be feasible to fabricate a complete system and put it in operation by early 1978. Although these objectives were generally met, considerable work remains to be done on the routing system. Author

N76-33472*# Oceanic Society, San Francisco, Calif.
DEVELOPMENT AND FIELD TESTING OF A LIGHT AIRCRAFT OIL SURVEILLANCE SYSTEM (LAOSS) Final Report
William Burns and Michael J. Herz Washington NASA Oct. 1976 28 p refs Sponsored by NASA and Coast Guard
(NASA-CR-2739; CG-D-1-76) Avail: NTIS HC $4.00 CSCL 14B

An experimental device consisting of a conventional TV camera with a low light level photo image tube and motor driven polarized filter arrangement was constructed to provide a remote means of discriminating the presence of oil on water surfaces. This polarized light filtering system permitted a series of successive, rapid changes between the vertical and horizontal components of reflected polarized skylight and caused the oil based substances to be more easily observed and identified as a flashing image against a relatively static water surface background. This instrument was flight tested, and the results, with targets of opportunity and more systematic test site data, indicate the potential usefulness of this airborne remote sensing instrument. Author

N76-33473*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTER PROGRAM FOR CALCULATING PRESSURE-BROADENED RAMAN SPECTRA FOR MOLECULAR NITROGEN AND OXYGEN
Gustave C. Fralick Washington Oct. 1976 31 p refs
(NASA-TM-X-3427; E-8608) Avail: NTIS HC $4.00 CSCL 07D

A computer program is given for calculating the rotational Raman spectrum for molecular nitrogen and oxygen. Provision is made for pressure broadening. Several sample calculations at various pressures are shown. The relative heights of some of the lines are affected by pressure broadening. Author

N76-33474*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
DEVELOPMENT OF LIGHTNING CURRENT DETECTOR
Stephen Livermore 24 Sep. 1976 37 p refs
(NASA-TM-X-74154; KSC-TR-1482) Avail: NTIS HC $4.00 CSCL 14B

A lightning current detector to record the maximum current amplitude of a lightning strike to the 150 meter weather tower at KSC was developed. The principle of operation of the detector is discussed, materials chosen to build the detector are described, and calibration tests performed on the detector are given. Field results of the detectors from two separate lightning strikes to the tower are included. Author

N76-33475*# McDonnell-Douglas Astronautics Co., Titusville, Fla.
FLUIDIC HYDROGEN DETECTOR PRODUCTION PROTOTYPE DEVELOPMENT Final Report, Nov. 1974 - Apr. 1976
G. W. Roe and R. E. Wright 16 Apr. 1976 155 p
(Contract NAS10-8764)
(NASA-CR-147984; L0341) Avail: NTIS HC $6.75 CSCL 14B

A hydrogen gas sensor that can replace catalytic combustion sensors used to detect leaks in the liquid hydrogen transfer systems at Kennedy Space Center was developed. A fluidic sensor concept, based on the principle that the frequency of a fluidic oscillator is proportional to the square root of the molecular weight of its operating fluid, was utilized. To minimize sensitivity to pressure and temperature fluctuations, and to make the sensor specific for hydrogen, two oscillators are used. One oscillator operates on sample gas containing hydrogen, while the other operates on sample gas with the hydrogen converted to steam. The conversion is accomplished with a small catalytic converter. The frequency difference is taken, and the hydrogen concentration computed with a simple digital processing circuit. The output from the sensor is an analog signal proportional to hydrogen content. The sensor is shown to be accurate and insensitive to severe environmental disturbances. It is also specific for hydrogen, even with large helium concentrations in the sample gas. Author

N76-33476# California Univ., Livermore. Lawrence Livermore Lab.
SUPERCONDUCTING JUNCTION BOLOMETERS Ph.D. Thesis
G. I. Hoffer Aug. 1975 102 p refs
(Contract W-7405-eng-48)
(LBL-3759) Avail: NTIS HC $8.25

A composite bolometer was developed in which the temperature-sensing element was a superconducting junction, the radiation absorber was a thin film of bismuth, and the support substrate was a piece of sapphire. The superconductor-normal metal-superconductor (SNS) junction and the superconductor-insulator-normal metal (SIN) junction were used. The performance of these bolometers was measured and compared with that calculated from fundamental noise limits. Near-ideal performance was achieved with the SNS bolometers. The sensitivity of the SIN bolometers was limited by amplifier noise, but certain improvements might provide performance comparable with that of the SNS bolometers. The absorption of infrared radiation by bismuth films of various thicknesses on sapphire substrates was measured over the frequency range 3 to 300 cm -1 using a Fourier-transform Michelson interferometer. The results were found to be in good agreement with theoretical calculations.
Author (NSA)

N76-33477# California Univ., Livermore. Lawrence Livermore Lab.
HSM, A MEASUREMENTS ENGINEERING CHALLENGE
W. M. Shay 8 Dec. 1975 95 p refs Revised
(Contract W-7405-eng-48)
(UCRL-51719-Rev-1) Avail: NTIS HC $5.45

Instrumentation of the aft warhead cases of a hard structure munition (HSM) weapon was developed to record dynamic data during detonation of 100 lb of explosive and the impacting of 15,000 lb of concrete. The case was instrumented primarily with strain gages and accelerometers. Maximum strains were generally less than 10,000 micron in./in.; accelerations were generally 100,000 g. An isolated recording system was developed that was immune to external noise sources; transducers were evaluated at anticipated maximum values. Parameters other than aft warhead cases were also measured. Author (ERA)

N76-33478# Ames Lab., Iowa.
INDUCTIVELY COUPLED PLASMA-ATOMIC EMISSION SPECTROSCOPY: AN ALTERNATIVE APPROACH TO FLAMELESS ATOMIC ABSORPTION SPECTROSCOPY
V. A. Fassel 1976 45 p refs Presented at ASTM Symp. on Flameless and Cold Vapor Atomic Absorption, Montreal, 22 Jun. 1975 Sponsored by ERDA
(IS-M-62; Conf-7506118-1) Avail: NTIS HC $4.00

Atomic emission spectroscopy (AES) combined with an inductively coupled plasma (ICP) excitation source is suggested as an alternative to flameless atomic absorption spectroscopy for the determination of trace elements in liquid samples of limited volume. The AES-ICP approach offers the potential advantage of being able to perform these determinations on a simultaneous multielement basis, and possesses an unusual degree of freedom from interelement effects if solution nebulization techniques are utilized. For one-milliliter sample volumes, the relative powers of detection (ng/ml) of the AES-ICP approach are comparable to the values reported for flameless atomic absorption procedures. ERA

N76-33479# California Univ., Livermore. Lawrence Livermore Lab.
STRAIN GAGES SUBJECTED TO A HIGH PRESSURE HYDROGEN ENVIRONMENT
R. J. Billia 25 Sep. 1975 10 p refs
(Contract W-7405-eng-48)
(UCID-16908) Avail: NTIS HC $4.00

Strain gages mounted on the inside of a thick walled pressure vessel experienced apparent zero shift or hysteresis effects when the pressurizing medium was hydrogen gas at 20 kpsi. The gages worked normally and predictably when helium gas was used. ERA

N76-33480# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
BENCH TEST PROCEDURES FOR S 331 (EM)
M. Candidi, M. J. Garvin (ESTEC, Noordwijk, Neth.), and R. Orfei Jul. 1974 58 p refs
(LPS-74-21) Avail: NTIS HC $4.50

The procedure for bench-testing the experimental breadboard magnetometer model, prior to integration, is presented. Before connection of the package to the test equipment, a preliminary mechanical inspection and electrical check was performed to ensure that damage was not sustained during handling. A detailed functional test program covering all stages of the experimental check-out, together with the expected standard outputs from such tests, is given. The following topics are dealt with: stimuli-simuli equipment, ground support equipment operation, line printer output format, preliminary checks prior to bench testing, and manual bench test sequence. Author (ESA)

N76-33481# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
DESCRIPTION OF THE XUV RADIATION MEASUREMENT INSTRUMENT ONBOARD ROCKET NIKE TOMAHAWK LAUNCHED FROM THE PLATFORM S.MARCO DURING THE ECLIPSE OF 30 JUNE 1973 [DESCRIZIONE DELLO

STRUMENTO PER LA MISURA DELLA RADIAZIONE XUV SUL RAZZO NIKE TOMAHAWK LANCIATO DALLA PIATTAFORMA S. MARCO DURANTE L'ECLISSI DEL 30 GIUGNO 1973]

L. Bartolini (CNEN, Frascati, Italy), R. Habel (CNEN, Frascati, Italy), G. Marangoni, and P. Saraceno Feb. 1975 48 p refs In ITALIAN

(LPS-75-3) Avail: NTIS HC $4.00

The XUV radiation measuring equipment, to measure the radiation absorption intensity of the atmosphere and the plasmasphere in the shadow zone of the eclipse is described. Six line intensities were studied: 1216 A and 1026 A hydrogen lines, 820 A and 920 A oxygen lines, and 584 A and 304 A helium lines. The payload included a 6 channel optical spectrometer and its associated electronics, magnetometers and solar sensors, telemetry system for the data transmission, and pyrotechnical equipment. The 6 channel electron multiplier, the calibration method, the associated mechanical, and the vacuum systems are described. ESA

N76-33482# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

EXPERIMENTAL RESULTS ON LOW NOISE AMPLIFIERS FOR GRAVITATIONAL RADIATION DETECTORS

C. Cordoni and G. V. Pallottino Mar. 1975 9 p refs

(LPS-75-7) Avail: NTIS HC $3.50

Two different circuits for low noise amplification of gravitational signals were considered and compared with respect to their noise performance. In both circuits the FET C413N made by Crystallonics is used. Results show that the noise characteristics are very similar and the simpler configuration can therefore be chosen for practical application. By operating the amplifier in the optimum temperature range of 120 to 150 K the voltage noise decreases by a factor of approx. 2 and the current noise decreases very strongly. In this case, therefore, the Faulkner technique can be used without problems due to the current noise contribution, even if practical problems arise due to the power dissipated by a large number of FETs and to the requirements of liquid nitrogen. From this viewpoint the use of a step-up transformer connected between the piezoelectric transducers and the amplifier could be considered. Author (ESA)

N76-33483# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

BENCH TEST PROCEDURES FOR S331 (QM-FM)

M. Candidi, M. J. Garvin (ESTEC, Noordwijk, Neth.), and R. Orfei Aug. 1975 62 p refs

(LPS-75-26) Avail: NTIS HC $4.50

The procedure for bench testing the experimental package S-331, manually prior to integration and with the checkout station after, is presented. Before connection of the package to the test equipment, a preliminary mechanical inspection and electrical check is performed to ensure that damage has not been sustained during handling. A detailed functional test program covering all stages of the experimental checkout, together with the expected standard outputs from such tests is given. The following topics are dealt with: stimuli-simuli equipment; ground support equipment operation; line printer output format; preliminary checks prior to bench testing; manual bench test sequence; and S 329 checkout and automatic checkout. Author (ESA)

N76-33484# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

RESPONSE CURVES FOR A SET OF COMBINATIONS OF SCHOTT FILTERS AND KODAK ASTRONOMICAL PLATES

L. Rossi Sep. 1975 18 p refs

(LPS-75-32) Avail: NTIS HC $3.50

In scientific astronomical photography it is necessary either to reproduce the standard wavelengths system or to know with accuracy the response curve of the system employed to reduce the data to standard data and thus to make the data comparable. For this purpose the response curves for a set of combinations, Schott filters UG1, GG305, GG495, RG 610, RG665, RG700; RGN9 and RG715 and Kodak plates 103O, 103F, 103aG, 103aE, Ia0, 103aD, IZ, IN, 103 H alpha, are given. Data were taken from Schott filter sensitivity curves and from Kodak publications. ESA

N76-33485# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

ELECTRONIC INSTRUMENTATION FOR A BALLOON-BORNE EXPERIMENT IN IR ASTRONOMY

S. Cantarano, G. V. Pallottino, and V. Natale (CNR, Bologna) Apr. 1976 41 p refs

(LPS-76-10) Avail: NTIS HC $4.00

The electronics for a balloon-borne polarimeter operating in the 100 to 2000 micron wavelength range with a spurious polarization less than 0.1%, which has been successfully employed in the balloon flight in July 1971, is described. Measurements of the polarized infrared radiation from celestial bodies, in the 100 to 2000 micron range, are presented. The control circuitry is discussed, including topics such as pointing control of the optical bench, black body for in-flight bolometer calibration and temperature measurement, chopper velocity, check of the power supplies, and opening of the door. The PCM telemetry system is outlined. Author (ESA)

N76-33486# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

INDIUM ANTIMONIDE FAR INFRARED DETECTORS [RIVELATORI AD ANTIMONIURO D'INDIO PER IL LONTANO INFRAROSSO]

F. Bordoni, L. Rossi, and P. Saraceno Nov. 1974 46 p refs In ITALIAN

(LPS-74-26) Avail: NTIS HC $4.00

A new type of far infrared radiation detectors based on carrier mobility variation is presented. The theory of electronic bolometers is detailed with regard to time response and sensitivity. A detailed study of intrinsic noise was performed with regard to the type of electronics to be used with such detectors. Experimental results are given. ESA

N76-33487# Explosives Research and Development Establishment, Waltham Abbey (England).

A MECHANICAL DEVICE FOR THE MEASUREMENT OF BLADE-TO-WALL CLEARANCES IN ENCLOSED VERTICAL MIXING MACHINES

R. Durrant 1975 14 p refs

(ERDE-TN-130; BR47032) Avail: NTIS HC $3.50

The device described was developed for use with a 10 gal vertical mixer of figure of eight design fitted with two equispeed semihelical solid blades rotating in fixed bearings. Blade to wall clearances are approximately 5 mm. High spots are detected from a linear reproduction of clearances on a paper record. The device can readily be used for a wide range of blade sizes and clearances. Risk of detachment from the blade is slight and resultant damage unlikely due to lightness. Author (ESA)

N76-33488# Army Electronics Command, Fort Monmouth, N.J.

A PROCEDURE TO PROCESS 2445 AEROCOLOR NEGATIVE FILM IN THE EH-29B PROCESSOR Final Report

Keith C. Donaldson and Seymour L. Hersh Mar. 1976 17 p

(DA Proj. 1S7-62703-DH-93; DA Proj. 1S6-62703-A-176)

(AD-A022208; ECOM-4394) Avail: NTIS CSCL 14/5

This report describes processing procedures required to process Eastman Kodak Aerocolor Negative Film, Type 2445, in the EH-29B Black-and-White Processor. A replenishment rate was determined which has permitted processing up to four rolls, 100 feet x 5 inch, of 2445 film per solution batch. Color balance shifts are maintained within tolerable limits, and speed losses are held to approximately one-half stop. Also described is a mechanical modification to the drive train which improves the setting accuracy of slower through-put rates. GRA

N76-33489# Wayne State Univ., Detroit, Mich. Coll. of Engineering.

DESIGN INVESTIGATION OF INERTIA MEASURING PLATFORM Final Report

David Orne Aug. 1975 141 p refs

(Contract DAAE07-73-C-0281; DA Proj. 1T5-62601-A-045; DA Proj. 1T6-62601-AH-91)

(AD-A023983; TACOM-TR-11922) Avail: NTIS CSCL 20/11

An Inertia Measuring Platform (IMP) is proposed for the purposes of experimentally determining the location of the center of gravity and the moments and products of inertia of vehicles and vehicular components weighing as much as 28,000 lbs.

The IMP consists of a rigid lightweight space truss which supports the test item and which itself is supported by four sloping cables which intersect at a point, the instantaneous center of rotation, well below the center of gravity of the platform. GRA

N76-33490# Olson Labs., Inc., Anaheim, Calif.
STUDY OF AN ULTRASONIC VORTEX FLOWMETER FOR MEASUREMENT OF MOBILE SOURCE MASS EMISSIONS. PHASE 2: CONTINUOUS MASS MEASUREMENT SYSTEM
Jan. 1976 194 p refs Sponsored by Coordinating Res. Council, New York
(PB-251165/7; CRC-APRAC-CAPE-22-72-2) Avail: NTIS HC $7.50 CSCL 14B

An ultrasonic vortex flowmeter was demonstrated to prove that it could be used to provide real time, continuous plotting of mass emission rates and fuel consumption rates. The accuracy of the system was evaluated by performing 41 simultaneous continuous mass emission and constant volume sampling bag measurements. Reasonably high correlation coefficients were obtained for HC and CO. Slightly lower correlation coefficients were obtained for CO2 and NOx. Rather low correlation coefficients were obtained for fuel consumption. GRA

N76-33491# Research Triangle Inst., Research Triangle Park, N.C.
WIND TUNNEL EVALUATION OF PARTICLE SIZING INSTRUMENTS Final Task Report
Charles H. Gooding Mar. 1976 75 p refs
(Contract EPA-68-02-1398)
(PB-251172/3; EPA-600/2-76-073) Avail: NTIS HC $4.50 CSCL 14B

Fly ash from a coal-fired power plant was redispersed and fed into a wind tunnel at concentrations corresponding roughly to clean and dirty stack conditions. Data were obtained with two standard cascade impactors (using gravimetric mass determination), a set of series cyclones, a cascade impactor with piezoelectric crystal sensors, a cascade impactor using beta attenuation to determine collected mass, and an optical single-particle counter using a laser light source. No simple correlation could be established between the results of the optical instrument and those of the inertial classification devices, due to the probable nonuniformity of particle shape and density. GRA

N76-33492# National Bureau of Standards, Washington, D.C.
DEVELOPMENT OF SOLID STATE SAMPLERS FOR WORK ATMOSPHERES: PHOSPHINE Summary Report, Jul. 1974 - Jun. 1975
Bernard Greiper and John K. Taylor Jan. 1976 32 p refs
(PB-251220/0; NBSIR-75-977) Avail: NTIS HC $4.00 CSCL 14B

Investigations to find suitable solid state sorber materials for phosphine in work atmospheres at the ppm level are described. The best sorber to date is silver nitrate impregnated silica gel. Some difficulties remain to be overcome before a procedure for determining the amount of phosphine adsorbed can be recommended. GRA

N76-33493# Aerospace Corp., El Segundo, Calif. Materials Science Lab.
GYRO TORQUER SHORT ANALYSIS Final Report, Jun. 1973 - Mar. 1974
Richard H. Jones 20 Nov. 1975 31 p
(Contract F04701-75-C-0076)
(AD-A024423; TR-0076(6950-07)-2S; SAMSO-TR-76-74) Avail: NTIS CSCL 17/7

A cooperative examination of short circuits in the torquer circuit of a gyroscope is described. The success of this examination was largely derived from careful planning that generated a list of 'all conceivable' short circuit models and guided each stage of the physical examination and testing to preserve the evidence so that each model could be checked. In the course of this plan, sectioning the gyro header revealed shorting bridges of electrodeposited copper that were identified by using the scanning electron microscope (SEM) and the ion microprobe mass analyzer (IMMA). With the defect-producing mechanism understood, particular remedial action could be recommended: in this case, removal of the circuit bias voltage that promoted electrodeposition of copper. Author (GRA)

N76-33494# Army Electronics Command, Fort Monmouth, N.J.
COMPARISON OF NVL MODEL AND FOUR CONTRACTOR MODELS FOR MINIMUM RESOLVABLE TEMPERATURE (MRT)
James A. Ratches Jan. 1976 29 p
(AD-A024467; ECOM-7050) Avail: NTIS CSCL 17/5

A comparison among MRT models for thermal systems is made. Four IR contractor models are compared to the NVL model. Basic assumptions and subjective parameter choices are examined and the differences are shown. Validation of the NVL model is documented against eight parallel and serial-scanned systems. Author (GRA)

N76-33495# Systems Research Labs., Inc., Dayton, Ohio.
ELEMENT DENSITY AND PERCENT ACTIVE AREA DESIGN REQUIREMENTS FOR LIQUID CRYSTAL DISPLAYS Final Report, 3 Feb. - 3 Jul. 1975
Kenneth R. Woodruff, Alan Pinkus, Wayne Martin, and Harry L. Task Wright-Patterson, AFB, Ohio AFAL Feb. 1976 56 p refs
(Contract F33615-74-C-1219)
(AD-A024026; AFAL-TR-75-235) CSCL 09/5

A study was performed to determine the impact of two important matrix display design variables on tactical target recognition performance. Element density (i.e., the visual angle subtended by individual display resolution elements) and the percent active area on the display surface were experimentally manipulated by adjusting viewing distance from a rear projection screen on which a grid mask was placed. The targets were presented to subjects using zoom imagery at a simulated slant range which initially precluded recognition. As the target size increased, subjects were asked to press a remote projector control button when they were 'virtually certain' of their responses. The results indicate little effect of percent active area (i.e., down to 55%) on target recognition performance for element angular subtense values between 0.75 and 3.0 minutes of arc (correponding to element densities of from approximately 165 to 40 elements per inch at a 28 inch viewing distance). The effects of element density, however, were large and conformed to expectations derived from the limiting resolution of the visual system. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N76-33496*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A STATUS OF PROGRESS FOR THE LASER ISOTOPE SEPARATION (LIS) PROCESS
Leon M. Delionback Sep. 1976 19 p refs
(NASA-TM-X-73345) Avail: NTIS HC $3.50 CSCL 20E

An overview of the Laser Isotope Separation (LIS) methodology is given together with illustrations showing a simplified version of the LIS technique, an example of the two-photon photoionization category, and a diagram depicting how the energy levels of various isotope influence the LIS process. Applications were proposed for the LIS system which, in addition to enriching uranium, could in themselves develop into programs of tremendous scope and breadth. These include the treatment of radioactive wastes from light-water nuclear reactors, enriching the deuterium isotope to make heavy-water, and enriching the light isotopes of such elements as titanium for aerospace weight-reducing programs. Economic comparisons of the LIS methodology with the current method of gaseous diffusion indicate an overwhelming advantage; the laser process promises to be 1000 times more efficient. The technique could also be utilized in chemical reactions with the tuned laser serving as a universal catalyst to determine the speed and direction of a chemical reaction. Author

N76-33497# California Univ., Livermore. Lawrence Livermore Lab.
LASER LIGHT SCATTERING AND ABSORPTION IN DENSE, SPHERICALLY SYMMETRIC PLASMAS Ph.D. Thesis

J. H. Erkkila Dec. 1975 139 p refs
(Contract W-7405-eng-48)
(UCRL-51914) Avail: NTIS HC $5.45

The interaction of a focused laser beam with a dense, spherically symmetric plasma was studied. The plasma was treated using linearized fluid equations for the electrons with the ions assumed immobile; the electromagnetic field was determined from steady state solutions to Maxwell's equations in spherical coordinates. Energy dissipation in the plasma occurred as a result of inverse bremsstrahlung collisions and resonance absorption. The scattered field distribution and the spatial variation of the fields and energy deposition within the plasma were found for various laser-plasma configurations and the applicability of the theory as a function of plasma temperature and laser power was determined with a self-consistent analysis. Author (NSA)

N76-33498# California Univ., Livermore. Lawrence Livermore Lab.

HIGH AVERAGE POWER, RARE-GAS HALOGEN-PUMPED IODINE LASER FOR FUSION APPLICATIONS

W. F. Krupke and E. V. George 20 Feb. 1976 27 p refs
Presented at the SPIE/SPSE Tech. Symp., Reston, Va., 22 Mar. 1976
(Contract W-7405-eng-48)
(UCRL-77523; Conf-760306) Avail: NTIS HC $4.00

Pumping atomic iodine photodissociation lasers using radiation from rare-gas halogen exciplexes were described. Two basic pumping methods (incoherent and coherent) were outlined in form, and some rough estimates of the relevant parameter ranges of important variables were given. The specific configurations described are two of many possible configurations and many alternatives exist. ERA

N76-33499# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.

RATE EQUATIONS OF THE SEMICONDUCTOR INJECTION LASER

Magnus Danielsen Jun. 1975 26 p refs
(TUD-R-139) Avail: NTIS HC $4.00

The rate equations of the injection laser are described, taking into account the influence of spontaneous emission on the dynamic behavior of the laser and the dependence of photon life time on the electron density. A computer program is presented and used to show the dynamic behavior with different values of the spontaneous emission parameter, different driving currents, and different starting conditions. Author (ESA)

N76-33500# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

NATURAL CONVECTION IN AN ENCLOSED GAS HEATED BY LOCAL LASER RADIATION Final Report, 1 Jan. 1974 - 1 Dec. 1975

Allan J. Ferrenberg and Kervyn D. Mach Mar. 1976 115 p refs
(AF Proj. 3048)
(AD-A023525; AFAPL-TR-76-11) Avail: NTIS CSCL 20/13

This report describes a technique by which the thermal effects of heating a gas by laser radiation absorption can be modelled. This is accomplished via a two-dimensional computer program which couples the equations of motion, energy, and continuity. The program models the convective motion of the gas during the irradiation period and predicts thermal and velocity distribution in the gas mixture. Any partially absorbing gas mixture can be considered, as long as sufficient thermophysical properties and absorption coefficients are known. Energy absorbed from the laser as a function of time can also be determined. GRA

N76-33501# Oregon Graduate Center for Study and Research, Beaverton.

PROPAGATION OF MULTIWAVELENGTH LASER RADIATION THROUGH ATMOSPHERIC TURBULENCE Interim Report, 1 Apr. - 31 Jul. 1975

J. Richard Kerr, Richard A. Elliott, J. Fred Holmes, Myung Lee, and Philip A. Pincus Mar. 1976 39 p refs
(Contract F30602-74-C-0082; ARPA Order 1279; AF Proj. 1279)
(AD-A023202; RADC-TR-76-49) Avail: NTIS CSCL 20/5

Recent activity on several topics in propagation through atmospheric turbulence is described in this report. The statistics of target or receiver irradiance, conditioned on a prior measurement of the instantaneous value, are considered under conditions of moderately strong fluctuations, and it is found experimentally that such scintillations are not described by a bivariate log normal distribution. A study of computer simulation techniques is described which has the goal of making possible realistic models of propagation paths for the short-term, time-dependent statistics of scintillation, including the effects of localized or intermittent strength of turbulence. The important future topic on this program will be the experimental and analytical determination of scintillations from laser-illuminated diffuse and general targets. A preliminary analysis of scintillations from a diffuse target is given, which is valid in the near field of the target illumination area. GRA

N76-33502# Bureau of Radiological Health, Rockville, Md. Div. of Compliance.

QUALITY CONTROL PRACTICES FOR COMPLIANCE WITH THE FEDERAL LASER PRODUCT PERFORMANCE STANDARD

Mar. 1976 29 p refs
(PB-254249/6; DHEW/PUBL/FDA-76/8036) Avail: NTIS HC $4.00 CSCL 06R

General principles and practices for the administration and conduction of a program of quality control for the manufacture of lasers and products containing lasers are presented for guidance in establishing programs to assure compliance with the Federal Performance Standard for Laser Products. Specific areas of administration and recordkeeping; testing before, during and after production; measuring instruments selection and calibration criteria; sampling criteria and sales and service information are treated in relation to performance and informational requirements of the standard. GRA

N76-33503# Bureau of Radiological Health, Rockville, Md. Div. of Compliance.

TABULATED VALUES OF ACCESSIBLE EMISSION LIMITS FOR LASER PRODUCTS

Mar. 1976 52 p refs
(PB-254254/6; DHEW/PUBL/FDA-76/8029) Avail: NTIS HC $4.50 CSCL 06R

The Federal performance standard for laser products (21 CFR 1040.10 and 1040.11) is presented. The standard provides for the classification of laser products into one of four progressively more hazardous classes. Accessible emission limits for each class are a function of the wavelength and emission duration and are listed in specified tables. The Bureau of Radiological Health computed the values of these limits at selected wavelengths and sampling intervals using the formulas in the tables. The computed results are presented in tabular form. GRA

N76-33504# Science Applications, Inc., Arlington, Va.

PROPAGATION MODELING AND ANALYSIS FOR HIGH ENERGY LASERS Final Report, Jul. 1974 - Mar. 1975

L. N. Peckham, P. R. Carlson, R. T. Liner, and C. W. Wilson Apr. 1975 161 p refs
(Contract N60921-75-C-0007)
(AD-A023537; SAI-74-629-WA) Avail: NTIS CSCL 20/6

This report analyzes simplified propagation codes and recommends improved models for characterizing the propagation of high energy CW laser beams. The following are included: A simplified optical train model; Creation of SAICOM computer program; Molecular absorption of DF laser radiation. GRA

N76-33505# Naval Research Lab., Washington, D.C.

LASER FOCAL SHIFT MONITOR

John A. Stamper Feb. 1976 9 p
(Contract AT(04-3)-878; NRL Proj. H02-29A)
(AD-A023064; NRL-MR-3255) Avail: NTIS CSCL 20/6

A change in the collimation angle (describing the overall beam divergence or convergence) causes a corresponding change in the laser focal position. The collimation angle of a ray can be expressed in terms of the ratio alpha of its position to slope at the lens. Changes in beam collimation delta alpha can be accurately determined by passing the beam through an apertured mask and recording its image at a distant location. For a plano-convex lens of thickness t and refractive index n, the focal

shift is given by delta f - ((f + (t/n)) squared)delta alpha. Shifts of a few micrometers can be measured when the distance between mask and image is sufficiently large. GRA

N76-33506# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
TUNABLE LASERS Semiannual Technical Report, 1 Jul. - 31 Dec. 1975
C. Forbes Dewey, Jr. and L. O. Hocker 31 Dec. 1975 47 p refs
(Contract N00014-76-C-0431; ARPA Order 2840)
(AD-A022162; FML-75-N2; SATR-3) Avail: NTIS CSCL 20/6

In the research on nonlinear crystals and processes for frequency mixing in the infrared there has been progress along two fronts. The authors have produced tunable infrared from 11 micrometers to 23 micrometers by mixing the output from two ruby-pumped dye lasers in proustite. Analysis of the output power versus wavelength showed that beam convergence at the nonlinear crystal can be responsible for a substantial reduction in output from that which one would expect were the crystal at the beam waste. This effect is studied quantitatively and an excellent agreement is found between theory and experiment. It is shown that there are applications where randomly twinned crystals could meet specific needs for crystals to be used in nonlinear mixing processes. The authors have made a preliminary theoretical investigation of the effects of crystal absorption and twin spacing on the power production from a randomly twinned crystal. The authors have also found the probability distribution function for the power produced by a randomly twinned crystal. GRA

N76-33507# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DIFFUSE TARGET SCINTILLATION IN 10.6-MICROMETER LASAR RADAR
Steven P. Tomczak 8 Mar. 1976 76 p refs
(Contract F19628-76-C-0002; ARPA Order 2752)
(AD-A024310; TT-9; ESD-TR-76-63) Avail: NTIS CSCL 17/8

This study is concerned with effects of diffuse target scintillation on 10.6-micrometer heterodyne line scan systems where the objective was to identify the problem areas which would eventually control the limiting factors in the image and MTI performance of line scan systems. In particular, diffuse target scintillation (speckle) was recognized as one of the limiting factors for a heterodyne receiver design and this study is concerned with the statistics of speckle noise and with speckle reduction techniques. Author (GRA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N76-33508*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLEXURAL FATIGUE OF HOLLOW ROLLING ELEMENTS
Eric N. Bamberger, Richard J. Parker, and Marshall W. Dietrich Washington Oct. 1976 24 p refs
(NASA-TN-D-8313; E-8621) Avail: NTIS HC $3.50 CSCL 13I

Hollow cylindrical bars were tested in the rolling-contact fatigue tester to determine the effects of material and outside diameter to inside diameter (OD/ID) ratios of 2.0, 1.6, 1.4, and 1.2 on fatigue failure mode and subsequent failure propagation. The range of applied loads with these OD/ID ratios resulted in maximum tangential tensile stresses ranging from 165 to 655 megapascals (24,000 to 95,000 psi) at the bore surface. Flexural failures of the hollow test bars occurred when this bore stress was 490 megapascals (71,000 psi) or greater with AISI 52100 hollow bars and 338 megapascals (49,000 psi) or greater with AISI M-50 hollow bars. Good correlation was obtained in relating the failures of these hollow bars with flexural failures of drilled balls from previously published full scale bearing tests. Author

N76-33509*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ISOTHERMAL ELASTOHYDRODYNAMIC LUBRICATION OF POINT CONTACTS. 4: STARVATION RESULTS
Bernard J. Hamrock and Duncan Dowson Washington Oct. 1976 33 p refs
(NASA-TN-D-8318; E-8733) Avail: NTIS HC $4.00 CSCL 13I

The influence of lubricant starvation on minimum film thickness was investigated by moving the inlet boundary closer to the contact center. The following expression was derived for the dimensionless inlet distance at the boundary between the fully flooded and starved conditions: $m^* = 1 + 3.06 ((R/b)(R/b)H)$ to the power 0.58, where R is the effective radius of curvature, b is the semiminor axis of the contact ellipse, and H is the central film thickness for fully flooded conditions. A corresponding expression was also given based on the minimum film thickness for fully flooded conditions. Therefore, for $m < m^*$, starvation occurs and, for $m > m^*$, a fully flooded condition exists. Two other expressions were also derived for the central and minimum film thicknesses for a starved condition. Contour plots of the pressure and the film thickness in and around the contact are shown for the fully flooded and starved lubricating conditions, from which the film thickness was observed to decrease substantially as starvation increases. Author

N76-33510*# Kanner (Leo) Associates, Redwood City, Calif.
UNDERWATER REMOTE CONTROLLED VEHICLES (WITH MANIPULATORS)
V. S. Yastrebov Washington NASA Oct. 1976 218 p refs Transl. into ENGLISH of the book "Teleupravlyayemyye podvodnyye apparaty (s manipulyator ami)", Sudostroyeniye Press, Leningrad, 1973 p 1-199
(Contract NASw-2790)
(NASA-TT-F-17190) Avail: NTIS HC $7.75 CSCL 13J

Problems of designing underwater remote controlled vehicles equipped with manipulator or devices, a fast-developing means of ocean exploration, were considered. An attempt is made at an integrated approach to studying the system underwater remote controlled device-manipulator. The usefulness of formulating generalized principles for building remote controlled systems for underwater vehicles based on manipulators is noted. Heavy stress is given to analyzing the multidimensional structure of manipulators, serving as the primary working equipment in underwater remote controlled vehicles. Author

N76-33511# Mound Lab., Miamisburg, Ohio.
CONDUCTIVE POLYSTYRENE BEAD FOAM MATERIAL
H. R. McGraw and W. L. Hood 30 Dec. 1975 17 p refs
(Contract E(33-1)-GEN-53)
(MLM-2192) Avail: NTIS HC $4.00

A paint was found that adheres well to polystyrene bead foam and affords an electrically conductive surface that readily discharges any electrostatic charges imposed on it. The alternate method for making the polystyrene bead foam conductive by adding the conductive material prior to forming the foam was tried with beads coated with carbon. The resulting foamed specimens had suitable electrical conductivities but were unsatisfactory because of their low structural strengths. Author (ERA)

N76-33512# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LEAN MIXTURE ENGINES TESTING AND EVALUATION PROGRAM. VOLUME 1: EXECUTIVE SUMMARY Final Report, May - Dec. 1974
Mack W. Dowdy, Frank W. Hoehn, and Tom G. Vanderbrug Nov. 1975 31 p refs 3 Vol.
(Contract DOT-TSC-RA-74-38-TMP-0223)
(PB-251765/4; JPL-5040-12-Vol-1; DOT-TSC-OST-75-26.1-Vol-1) Avail: NTIS HC $4.00 CSCL 21B

Fuel consumption and emissions data are obtained on the engine dynamometer for the baseline engine, and two lean-burn configurations of the same engine and data comparisons are made. Individual cylinder equivalence ratios are measured to evaluate the cylinder-to-cylinder distribution. Pressure-time traces from individual cylinders are used to get information about ignition delay, combustion duration and cycle-to-cycle pressure variations. Fuel consumption and emissions data for one lean-burn configuration are obtained over the Federal Driving Cycle using a chassis dynamometer and the results are compared with the stock baseline

results. Using experimental results and information from the existing literature, the potential of the lean-burn concept is assessed using the Blumberg-Kummer cycle analysis program. GRA

N76-33513# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LEAN MIXTURE ENGINES TESTING AND EVALUATION PROGRAM. VOLUME 3: APPENDICES Final Report, May - Dec. 1974
Mack W. Dowdy, Frank W. Hoehn, and Tom G. Vanderbrug Nov. 1975 84 p 3 Vol.
(Contract DOT-TSC-RA-74-38-TMP-0223)
(PB-251767/0; JPL-5040-12-Vol-3; DOT-TSC-OST-75-26.3-Vol-3) Avail: NTIS HC $5.00 CSCL 21B

For abstract, see N76-33512.

N76-33514# Naval Civil Engineering Lab., Port Hueneme, Calif.
UNDERWATER-APPLIED COATINGS FOR STEEL STRUCTURES Final Report, Jul. 1973 - Jun. 1975
Richard W. Drisko Mar. 1976 22 p refs
(YF54593006)
(AD-A022450; CEL-TN-1426) Avail: NTIS CSCL 11/3

Several underwater-applied epoxy coatings were developed for protecting steel structures in seawater. The more promising formulations were laboratory and field tested at different times using a brush, a roller, and a curved plastic applicator developed by the Navy Coastal Systems Laboratory. The coating that was the easiest to apply underwater is now marketed by a commercial supplier. Sandblasting was found to be the best method of preparing steel surfaces for painting underwater, and waterblasting was the next best of the five methods tested. Author (GRA)

N76-33515# British Steel Corp., Sheffield (England). Information Services.
ELECTROSLAG PROCESSES. PART 2: WELDING, A BIBLIOGRAPHY OF THE LITERATURE PUBLISHED DURING 1974
A. Armstrong Feb. 1976 28 p refs
(PB-250904/0; CDL/INF/3/75-Pt-2) Avail: NTIS HC $4.00 CSCL 13H

This bibliography contains 94 references, which were selected from published literature during 1974. The items, which are related to ferrous metallurgy, are arranged according to the following subject headings: general articles on electroslag welding techniques; specific applications; properties of electroslag welds; surfacing techniques. A personal author index based on first author only is included. GRA

N76-33516# British Steel Corp., Sheffield (England). Information Services.
THE INFLUENCE OF VANADIUM ON SUBMERGED-ARC WELD METAL TOUGHNESS
J. G. Garland and P. R. Kirkwood Feb. 1976 34 p refs
(PB-250899/2; GS/PROD/643/1/75/C) Avail: NTIS HC $4.00 CSCL 11F

It is shown that satisfactory levels of weld metal toughness are achieved irrespective of plate vanadium level. Practical recommendations regarding consumable and procedure selection for applications, in which stringent weld metal toughness requirements are mandatory, are made. Results are considered in the light of weld metal toughness models, which have proved capable of explaining the complex trends in weld metal properties recorded in the presence of V. GRA

N76-33517# Babcock and Wilcox Co., Alliance, Ohio.
FUNCTIONAL PERFORMANCE OF THE HELICAL COIL STEAM GENERATOR, CONSOLIDATED NUCLEAR STEAM GENERATOR (CNSG) 4 SYSTEM. EXECUTIVE SUMMARY
G. B. Watson Oct. 1975 58 p
(Contract MARAD-1-35555)
(PB-253323/0; ARC-5178-ES; MA-RD-920-76018-ES) Avail: NTIS HC $4.50 CSCL 21F

Functional performance of the CNSG - 4 helical steam generator was evaluated to demonstrate that the generator meets steady state and transient thermal-hydraulic performance specifications and that secondary flow instability will not be a problem. The helical steam generator concept will exceed the specific superheat of 35F at 100% load. Measured superheat at comparable operating conditions was 95F. Available computer codes accurately predicted trends and overall performance characteristics. Author

N76-33518# Babcock and Wilcox Co., Alliance, Ohio.
FUNCTIONAL PERFORMANCE OF THE HELICAL COIL STEAM GENERATOR, CONSOLIDATED NUCLEAR STEAM GENERATOR (CNSG) 4 SYSTEM Final Report
G. B. Watson Oct. 1975 184 p refs
(Contract MARAD-1-35555)
(PB-253324/8; ARC-5178-F; MA-RD-920-76018-F) Avail: NTIS HC $7.50 CSCL 21F

The two helical coils representing the steam generator in the CNSG - 4 were tested at full system pressures and temperatures for both the primary and secondary sides, using water as the test fluid. The arrangement schematic of the steam generator test facility used during the functional performance tests of the helical coil steam generator is presented. A generator was also used to provide an additional heat sink so the primary side furnace could be fired at a higher rate, yet be within its controllable range. GRA

N76-33519# Value Engineering Co., Alexandria, Va.
ACOUSTICAL NOISE STUDY FOR THE 18000 BTUH TOTAL ENVIRONMENTAL CONTROL SYSTEM
Dec. 1974 13 p refs
(Contract DAAK02-73-C-0045)
(AD-A023851) Avail: NTIS CSCL 13/1

The purpose of this task was to determine the sound pressure levels of the 18,000 BTUH Total Environmental Control System (TECS) and to compare these levels with standard sound criteria. The sound pressure levels were measured with the TECS installed in an S-141 Shelter as well as under free field conditions. The criteria for the evaporator side of the installed equipment are found in MIL-STD-1474, Noise Limit Category E. All measured pressure levels were below the Category E limit by a substantial margin. The criteria for the condenser side of the equipment for an 8-hour exposure without hearing protection are found in MIL-STD-1474, Noise Limit Category D. Again, all measured pressure levels were below the criteria limit by a substantial margin. GRA

N76-33520# Value Engineering Co., Alexandria, Va.
METHODS FOR INSTALLING THE 18000 BTUH TOTAL ENVIRONMENTAL CONTROL SYSTEM IN TRAILERS AND SHELTERS
Aug. 1974 42 p refs
(Contract DAAK02-73-C-0045)
(AD-A024650) Avail: NTIS CSCL 13/1

The purpose of this task was to determine methods by which the 18,000 BTUH Total Environmental Control System (TECS) can be mounted to those shelters most likely to have a requirement for environmental control. It was intended that a number of methods be determined to give the the user maximum flexibility to mount the TECS Unit in any particular application. Those shelters most likely to have auxiliary requirements for mechanical cooling and other environmental control were determined from a review of the report 'Shelter Requirements for the Army in the Field, 1966 - 1980 Final report.' Based on this review, the following typical shelters were investigated, e.g., Shelter S-280, Semitrailer M-119, and Semitrailer M-373. The investigation showed the construction of these shelters is similar enough that mounting designs could be based on a generalized shelter construction concept. In this report six methods of mounting the TECS Unit are described. These methods have been analyzed, and it has been determined that they can withstand normal transportation shock loads. It is also possible to extract features from one method and combine them with features from other methods. These methods, with the variations possible, can be used in most applications for installation of the TECS Unit in the shelters forecasted for the Field Army up to 1980. Author (GRA)

N76-33521# Massachusetts Inst. of Tech., Cambridge.
DEVELOPMENT OF THE VALVED HOT-GAS ENGINE Final Report
Joseph L. Smith, Jr. Aug. 1975 147 p refs

(Contract DOT-OS-40086)
(PB-253151/5; DOT/TST-76/34) Avail: NTIS HC $6.00 CSCL 21G

The valved hot-gas engine (VHGE) is a closed - regenerative - cycle engine operating on a helium Brayton cycle, and employing a reciprocating expander/compressor. The performance of the experimental engine was measured in detail, and is reconciled with analysis which includes the unsteady internal processes of the cylinder. Variable valve timing for high efficiency control of engine power was studied. Improvements were made to allow full power operation of the experimental engine. Projected potential of the engine is confirmed by identification of causes of lower than theoretical performance. GRA

N76-33522# Pennsylvania State Univ., University Park. Applied Research Lab.
DYNAMIC VIBRATION ABSORBERS OF CONVENTIONAL AND NOVEL DESIGN M.S. Thesis
Matthew A. Nobile 15 Oct. 1975 168 p refs
(Contract N00017-73-C-1418)
(AD-A023816; TM-75-293) Avail: NTIS CSCL 20/11

The behavior of dynamic vibration absorbers of conventional and novel design has been investigated experimentally. Transmissibility and relative displacement measurements have been obtained for absorbers attached to a one-degree-of-freedom primary system, and the resultant data have been compared with the predictions of existing theories. The absorbers tested ranged from those possessing a conventional mass-spring-dashpot configuration, to those possessing novel configurations. In all cases, the experimental results were in close agreement with theoretical predictions. The novel configurations included (1) an absorber employing a viscoelastic (Butyl rubber) material as a combined spring-and-damper element, (2) absorbers employing damped laminated beams as spring-and-damper elements, (3) so-called 'dual dynamic absorbers' -- a conventional, viscously damped absorber in parallel with a less massive undamped absorber, and (4) a single nominally undamped absorber or a pair of nominally undamped absorbers attached to a heavily damped primary system. GRA

N76-33523# Ricardo & Co., Engineers (1927), Ltd., Shoreham-by-Sea (England).
A STUDY OF STRATIFIED CHARGE FOR LIGHT DUTY POWER PLANTS, VOLUME 2 Final Report
Oct. 1975 143 p
(Contract EPA-68-03-0375)
(PB-253767/8; DP-20437-Vol-2; EPA-460/3-74-011-b) Avail: NTIS HC $6.00 CSCL 13F

The objectives of this project were to determine the acceptability of various types of stratified charge engines as potential power plants for light duty vehicles and motorcycles in America. The light duty vehicle considered was a 4/5 seat compact sedan with good acceleration capabilities and exhaust emissions below a primary target of 0.41 g/mile HC, 3.4 g/mile CO, 1.5 g/mile NOx. A literature survey was undertaken comparing stratified charge engines with examples of good conventional gasoline and diesel engines. Eleven engines were configured, four of which were specifically directed towards the secondary emission targets. A method of rating the engines was derived, and the design concepts were compared with two gasoline engines by a jury panel. GRA

N76-33524# British Steel Corp., Sheffield (England). Information Services.
A REAPPRAISAL OF THE RELATIONSHIP BETWEEN FLUX BASICITY AND MECHANICAL PROPERTIES IN SUBMERGED-ARC WELDING
J. G. Garland and P. R. Kirkwood Apr. 1976 25 p refs
(PB-254196/9; GS/PROD/176/21/75/C) Avail: NTIS HC $3.50 CSCL 13H

It is demonstrated that the shape of the Charpy transition curves and the relative energy levels with different fluxes at specific weld heat inputs and test temperatures can be rationalized. Attention is drawn to the importance of resistance to the onset of cleavage with higher flux basicities and the practical restriction placed on their use. Fully basic fluxes do provide deposits whose cleanliness is such that inherently very high energy absorptions are possible. Submerged arc welding wire developments are outlined, and an effective means of overcoming current restrictions on the use of fully basic fluxes is given. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N76-33525*# General Dynamics/Fort Worth, Tex.
ASSESSMENT OF NDE RELIABILITY DATA Final Report, Jul. 1974 - Sep. 1975
B. G. W. Yee, F. H. Chang, J. C. Covchman, G. H. Lemon, and P. F. Packman (Vanderbilt Univ., Nashville) Oct. 1976 444 p refs
(Contract NAS3-18907)
(NASA-CR-134991) Avail: NTIS HC $11.75 CSCL 14D

Twenty sets of relevant Nondestructive Evaluation (NDE) reliability data have been identified, collected, compiled, and categorized. A criterion for the selection of data for statistical analysis considerations has been formulated. A model to grade the quality and validity of the data sets has been developed. Data input formats, which record the pertinent parameters of the defect/specimen and inspection procedures, have been formulated for each NDE method. A comprehensive computer program has been written to calculate the probability of flaw detection at several confidence levels by the binomial distribution. This program also selects the desired data sets for pooling and tests the statistical pooling criteria before calculating the composite detection reliability. Probability of detection curves at 95 and 50 percent confidence levels have been plotted for individual sets of relevant data as well as for several sets of merged data with common sets of NDE parameters. Author

N76-33526*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INSPECTION OF COMPOSITES USING A COMPUTER-BASED REAL-TIME RADIOGRAPHIC FACILITY
Ernest Roberts, Jr. and Alex Vary 1976 12 p refs Presented at the 2d Conf. on Automated Inspection and Product Control, Chicago, 19-21 Oct. 1976
(NASA-TM-X-73504) Avail: NTIS HC $3.50 CSCL 14D

A radiographic inspection facility was developed at the NASA Lewis Research Center. The facility uses a digital computer to provide enhanced images in near real-time. Some capabilities of the facility are demonstrated in the inspection of a fan frame ring for an experimental aircraft gas turbine. The ring was fabricated from a carbon-fiber-reinforced epoxy composite material. Inspection procedures were evaluated, and comparisons were made with an ultrasonic C-scan and conventional film X-ray. Author

N76-33527# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
EXPERIMENTAL DEVICE FOR THE CALIBRATION OF EXPERIMENT S-406 [APPARATO SPERIMENTALE PER LE TARATURE DELL ESPERIMENTO S-406]
P. Cerulli-Irelli May 1975 27 p refs In ITALIAN
(LPS-75-16) Avail: NTIS HC $4.00

The automated instrumentation for calibrating the S-406 experiment to be flown on the ISEE-B satellite is described. The experiment is described with regard to proton source, particle analyzer, control electronics, and optoelectronic transducer. The rotating platform for vacuum chamber experiments is described together with the servicing to the HP 246 B computer and associated tape recorder. The set of measurements is discussed. ESA

N76-33528# Macrodata Corp., Woodland Hills, Calif.
RELIABILITY EVALUATION OF SEMICONDUCTOR MEMORIES Final Report
Albert C. L. Chiang Griffiss AFB, N. Y. RADC Feb. 1976 277 p
(Contract F30602-74-C-0093; AF Proj. 5519)
(AD-A022862; RADC-TR-76-16) Avail: NTIS CSCL 09/2

The report presents a study which was conducted to evaluate the reliability of high usage semiconductor memories. The study determined parametric and functional tests which are required for military specifications. Special attention was given to the application of functional tests to detect and screen out devices with pattern sensitivity. Five types which cover a large part of the wide spectrum of memory devices in use today were chosen for characterization and testing to determine optimum parametric and functional tests and limits required in military specifications for memories. GRA

N76-33529# Rockwell International Science Center, Thousand Oaks, Calif.
ANALYSIS OF ULTRASONIC WAVE SCATTERING FOR CHARACTERIZATION OF DEFECTS IN SOLIDS Interim Report
E. Richard Cohen and B. R. Tittmann Dec. 1975 61 p refs
(Contract F44620-74-C-0057; AF Proj. 9782)
(AD-A023136; SCTR-75-12; AFOSR-76-0385TR) Avail: NTIS CSCL 14/2

The report summarizes the results of a program to characterize the scattering of ultrasonic acoustic waves by defects in solids. The program is intended to analyze and verify by direct measurement scattering by spheroidal cavities and inclusions in a metallic matrix. The work to date has been confined to analysis of spherical scatterers and the measurement of scattering from spherical voids. The measured scattering patterns are in agreement with the predictions of the theory. The observed deviations may be understood as due to the effects of the pulse shape and finite pulse length of the transmitting transducer compared to the monochromatic wave form of the theoretical analysis. It is concluded even from these limited measurements that a spherical cavity has the characteristics necessary for use as standard defect for NDT. Author (GRA)

N76-33530# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
ON HIGH SUPPORT COSTS AND POOR RELIABILITIES IN AIR FORCE AIRCRAFT EQUIPMENTS Final Report
Russell M. Genet and S. Woodrow Hall, Jr. 9 Mar. 1976 19 p
(AD-A023836; ASD/RAXA-76-2) Avail: NTIS CSCL 01/3

Common statements and opinions about the 'high support costs and poor reliabilities' of items of aircraft equipment are discussed. A distinction is made between statements that are objectively confirmable, at least in theory, and those that must, by their nature, remain forever subjective. For those statements where objective confirmation is possible, the outline of an analytic approach aimed towards reaching such objectivity is offered. GRA

N76-33531# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
REDUCING SUPPORT COSTS AND IMPROVING RELIABILITIES/AVAILABILITIES OF AIR FORCE AIRCRAFT EQUIPMENT Final Report
Russell M. Genet, S. Woodrow Hall, Jr., and Gordon W. Spray 7 Apr. 1976 28 p
(AD-A023835; ASD/RAXA-76-4) Avail: NTIS CSCL 01/3

Common statements and opinions about the 'high support costs and poor reliabilities' of items of equipment are discussed. A distinction is made between statements that are objectively confirmable, at least in theory, and those that must, by their nature, remain forever subjective. For those statements where objective confirmation is possible, an analytic approach aimed towards reaching such objectivity is outlined. Logical remedies for severe cases are suggested. A program for analysis and subsequent actions is outlined. Specific program tasks are delineated. GRA

N76-33532# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
ON THE REDUCTION OF OPERATING AND SUPPORT COSTS OF AIR FORCE AIRCRAFT Final Report
Russell M. Genet 10 Mar. 1976 20 p
(AD-A023834; ASD/RAXA-76-3) Avail: NTIS CSCL 01/3

Conceptual approaches and difficulties involved in reducing the operating and support costs of Air Force aircraft are discussed. GRA

N76-33533# Florida State Univ., Tallahassee. Dept. of Statistics.
MULTIVARIATE LIFE TABLE ANALYSIS Interim Report
Richard E. Barlow (Calif. Univ., Berkeley) and Frank Proschan Jan. 1976 20 p refs
(Contracts N00014-75-C-0781; AT(49-24)-0147; Grant AF-AFOSR-2581-74; AF Proj. 9769)
(AD-A023060; FSU-Statistics-M366; AFOSR-76-0294TR; TR-60) Avail: NTIS CSCL 12/1

A theory of multivariate life table analysis is developed. Estimators are developed for various multivariate interval failure rates. These estimators are multivariate extensions of the usual estimator in the univariate case. Under appropriate conditions, the estimators are shown to be asymptotically normal and asymptotically independent. The key tool used is a theorem of Sethuraman (1963) 'Some limit distributions connected with fixed interval analysis', Sankhya, Series A, 25, 395-398. GRA

N76-33534# Nuclear Regulatory Commission, Washington, D.C. Office of Nuclear Reactor Regulation.
EVALUATION OF THE INTEGRITY OF REACTOR VESSELS DESIGNED TO ASME CODE, SECTIONS 1 AND/OR 8
K. G. Hoge Jun. 1976 74 p refs
(PB-254736/2; NUREG-0081) Avail: NTIS HC $4.50 CSCL 18J

The design specifications and quality assurance programs used for the reactor vessel construction, and the status of these plants material surveillance programs, pressure temperature operating limits and inservice inspection programs are considered. Reactor vessels for light-water power reactors are covered. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N76-33535# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Darmstadt (West Germany). Lab. fuer Betriebsfestigkeit.
THE INFLUENCE OF STIFFENERS ON FATIGUE-CRACK-PROPAGATION
H. Huth, J. J. Gerharz, and D. Schuetz 22 Sep. 1975 47 p refs In GERMAN; ENGLISH summary
(FB-122(1975)) Avail: NTIS HC $4.00

The effects of stiffeners on the crack propagation behavior of a metal sheet are described. Possible forms of graphical data presentation are discussed. Influencing parameters are defined and their effects are investigated. The results of an extensive parametric study, using a computer program are presented in form of design graphs. The determination of the stress intensity factor by means of crack propagation tests, strain measurements, finite element and analytical calculations are described. The accuracy of these methods and the required effort is compared. Author

N76-33536# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Darmstadt (West Germany). Lab. fuer Betriebsfestigkeit.
FATIGUE BEHAVIOUR OF DUCTILE MATERIALS UNDER MULTIAXIAL OUT OF PHASE STRESSES WITH CONSTANT AND CHANGING DIRECTIONS OF PRINCIPAL STRESSES
A. Simbuerger 1975 237 p refs In GERMAN; ENGLISH summary
(FB-121(1975)) Avail: NTIS HC $8.00

A theory was developed for the fatigue behavior of ductile materials under multiaxial stresses. The resulting mathematical models and supporting computer programs are described. The validity of the theory was confirmed experimentally through a series of tests which are also documented. Author (ESA)

N76-33537# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Darmstadt (West Germany). Lab. fuer Betriebsfestigkeit.

THE APPLICATION OF DIGITAL COMPUTERS FOR INVESTIGATIONS IN FATIGUE OF STRUCTURES AND MATERIALS

O. Buxbaum, ed. and E. Haibach, ed. Dec. 1974 55 p refs In GERMAN; ENGLISH summary

(TB-117(1974)) Avail: NTIS HC $4.50

It is shown how digital computers are used for the analysis of measured load time histories, for the generation of random load sequences in fatigue testing, and for the theoretical prediction of fatigue life. Author

N76-33538# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Darmstadt (West Germany). Lab. fuer Betriebsfestigkeit.

THE PROCEDURE OF AMPLITUDE TRANSFORMATION

E. Haibach and H. P. Lehrke 1975 97 p refs In GERMAN; ENGLISH summary

(FB-125(1975)) Avail: NTIS HC $5.00

A procedure based on the hypothesis of linear damage accumulation and aimed at improving the fatigue life calculation of structural components was developed. A new concept enables changes of the local mean stress and interactions resulting from a complex loading sequence to be considered more effectively than by current methods. The basic idea is to decrease (or to increase) the nominal stress amplitude of each cycle analyzed in such a way that favorable (or detrimental) effects of mean stress and of interactions are covered. In a computer program the degree of amplitude transformation is derived from the hysteresis loop of the local stress and strain at the fatigue critical point of stress concentration by means of a properly defined damage parameter. Author

N76-33539# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Darmstadt (West Germany). Lab. fuer Betriebsfestigkeit.

SIGNIFICANCE OF IRREGULARITY OF GAUSSIAN RANDOM SEQUENCES ON FATIGUE LIFE

E. Gassner, H. Lowak, and D. Schuetz 1976 60 p refs In GERMAN; ENGLISH summary

(FB-124(1976)) Avail: NTIS HC $4.50

Notched specimen and single shear lap joints of the aluminum alloys 2024 were tested under axial random loading sequences to determine the influence of irregularity on fatigue life. The irregularity factors (1 = 0,99, 0,7, 0,3) cover the range interesting in practice. The method to generate random sequences ensures that the factor of irregularity is the only variable of the random sequence. For the notched specimens as well as for joints it is shown that fatigue lives defined by zero crossings grow with increasing irregularity, depending upon stress ratio for the notched specimens and upon stress ratio and stress level for joints. Author

N76-33540# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Darmstadt (West Germany). Lab. fuer Betriebsfestigkeit.

SIGNIFICANCE OF MEASURED LOCAL STRAINS FOR THE FATIGUE STRENGTH OF JOINTS

J. J. Gerharz and D. Schuetz 1976 53 p refs In GERMAN; ENGLISH summary

(FB-128(1976)) Avail: NTIS HC $4.50

Strains were measured with strain gages at filled holes of joints; clamping force, fit, and load transfer were varied. The gages were arranged to find out the effects of these parameters and parameter combinations on the local strain and stress and thus on the fatigue strength of the joint. In addition to the local stresses the amounts of secondary bending and load transfer were calculated and their interaction with clamping force and fit established. Fatigue strength related influence factors were determined by the local stresses occuring during a load cycle and compared with empirically derived factors. Author

N76-33541# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).

A STANDARD RANDOM LOAD SEQUENCE OF GAUSSIAN TYPE RECOMMENDED FOR GENERAL APPLICATION IN FATIGUE TESTING; ITS MATHEMATICAL BACKGROUND AND DIGITAL GENERATION

M. Hueck, W. Schuetz, R. Fischer (Lab. fuer Betriebsfestigkeit), and H.-G. Koebler (Lab. fuer Betriebsfestigkeit) Apr. 1976 22 p refs Presented at 42d AGARD meeting of the Struct. and Mater. Panel, Ottawa, 4-9 Apr. 1976 Sponsored by Ministry of Defence, Federal Republic of Germany

(LBF-2909; IABG-TF-570) Avail: NTIS HC $3.50

A load sequence has been developed that is recommended as a standard random load sequence for general application in fatigue testing. Considering a stationary Gaussian process to be approximately described as a Markovian sequence of peaks and troughs, the corresponding matrix of the transition frequencies may be computed. A procedure established for digitally generating a random sequence of peaks and troughs from the matrix ensures that the sequence is consistent with the matrix content, that it is periodically repeatable, and that it is exactly reproducible independent of the type of computer employed. The cumulative frequency distribution of the recommended random load sequence is equivalent to that of a stationary Gaussian process. Author

N76-33542# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Darmstadt (West Germany). Lab. fuer Betriebsfestigkeit.

APPLICATION OF DESIGN DATA DERIVED FROM FATIGUE TESTS WITH SERVICE LIKE LOAD SEQUENCES TO LIFE PREDICTION

D. Schuetz and H. Lowak 1976 60 p refs In GERMAN; ENGLISH summary

(FB-109(1976)) Avail: NTIS HC $4.50

Reliable fatigue life curves were established for a load sequence and a cumulative frequency distribution which are typical at the wing structure for transport aircraft. The life estimation for details subjected to load spectra varying from that applied to the specimens was demonstrated using relative Miner's rule. It was found that for large differences between the test load and the design load spectra relative Miner's rule is not advantageous. As the difference between the estimated life based on relative Miner's rule and the corresponding test results could be to a large extent explained by the action of residual stresses, a correction was introduced. The correction was applied to the specimens of this investigation using empirically derived data. The results proved that an effective refinement of the relative Miner's rule results in very accurate life predictions. Author

N76-33543*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

LaRC DESIGN ANALYSIS REPORT FOR NATIONAL TRANSONIC FACILITY FOR 9% NICKEL TUNNEL SHELL. VOLUME 1: FINITE DIFFERENCE ANALYSIS OF CONE/CYLINDER JUNCTION

James W. Ramsey, Jr., John T. Taylor, John F. Wilson, Carl E. Gray, Jr., Anne D. Leatherman, James R. Rooker, and Johnny W. Allred Sep. 1976 176 p

(NASA-TM-X-73956-1) Avail: NTIS HC $7.50 CSCL 13M

The results of extensive computer (finite element, finite difference and numerical integration), thermal, fatigue, and special analyses of critical portions of a large pressurized, cryogenic wind tunnel (National Transonic Facility) are presented. The computer models, loading and boundary conditions are described. Graphic capability was used to display model geometry, section properties, and stress results. A stress criteria is presented for evaluation of the results of the analyses. Thermal analyses were performed for major critical and typical areas. Fatigue analyses of the entire tunnel circuit are presented. Author

N76-33544*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

LaRC DESIGN ANALYSIS REPORT FOR NATIONAL TRANSONIC FACILITY FOR 9% NICKEL TUNNEL SHELL. VOLUME 2: FINITE ELEMENT ANALYSIS OF CORNERS 3 AND 4

James W. Ramsey, Jr., John T. Taylor, John F. Wilson, Carl E. Gray, Jr., Anne D. Leatherman, James R. Rooker, and Johnny W. Allred Sep. 1976 104 p

(NASA-TM-X-73956-2) Avail: NTIS HC $5.50 CSCL 13M

For abstract, see N76-33543.

N76-33545*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LaRC DESIGN ANALYSIS REPORT FOR NATIONAL TRANSONIC FACILITY FOR 9% NICKEL TUNNEL SHELL. VOLUME 3: FINITE ELEMENT ANALYSIS OF PLENUM REGION INCLUDING SIDE ACCESS REINFORCEMENT, SIDE ACCESS DOOR AND ANGLE OF ATTACK PENETRATION
James W. Ramsey, Jr., John T. Taylor, John F. Wilson, Carl E. Gray, Jr., Anne D. Leatherman, James R. Rooker, and Johnny W. Allred Sep. 1976 207 p
(NASA-TM-X-73956-3) Avail: NTIS HC $7.75 CSCL 13M
For abstract, see N76-33543.

N76-33546*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LaRC DESIGN ANALYSIS REPORT FOR NATIONAL TRANSONIC FACILITY FOR 9% NICKEL TUNNEL SHELL. VOLUME 4: THERMAL ANALYSIS
James W. Ramsey, Jr., John T. Taylor, John F. Wilson, Carl E. Gray, Jr., Anne D. Leatherman, James R. Rooker, and Johnny W. Allred Sep. 1976 147 p
(NASA-TM-X-73956-4) Avail: NTIS HC $6.00 CSCL 13M
For abstract, see N76-33543.

N76-33547*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LaRC DESIGN ANALYSIS REPORT FOR NATIONAL TRANSONIC FACILITY FOR 9% NICKEL TUNNEL SHELL. VOLUME 5: FINITE ELEMENT AND NUMERICAL INTEGRATION ANALYSES OF THE BULKHEAD REGION
James W. Ramsey, Jr., John T. Taylor, John F. Wilson, Carl E. Gray, Jr., Anne D. Leatherman, James R. Rooker, and Johnny W. Allred Sep. 1976 329 p
(NASA-TM-X-73956-5) Avail: NTIS HC $10.00 CSCL 13M
For abstract, see N76-33543.

N76-33548*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LaRC DESIGN ANALYSIS REPORT FOR NATIONAL TRANSONIC FACILITY FOR 9% NICKEL TUNNEL SHELL. VOLUME 6: FATIGUE ANALYSIS
James W. Ramsey, Jr., John T. Taylor, John F. Wilson, Carl E. Gray, Jr., Anne D. Leatherman, James R. Rooker, and Johnny W. Allred Sep. 1976 46 p
(NASA-TM-X-73956-6) Avail: NTIS HC $4.00 CSCL 13M
For abstract, see N76-33543.

N76-33549*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LaRC DESIGN ANALYSIS REPORT FOR NATIONAL TRANSONIC FACILITY FOR 9% NICKEL TUNNEL SHELL. VOLUME 7: SPECIAL STUDIES
James W. Ramsey, Jr., John T. Taylor, John F. Wilson, Carl E. Gray, Jr., Anne D. Leatherman, James R. Rooker, and Johnny W. Allred Sep. 1976 35 p
(NASA-TM-X-73956-7) Avail: NTIS HC $4.00 CSCL 13M
For abstract, see N76-33543.

N76-33550# Waterloo Univ. (Ontario). Solid Mechanics Div.
SOME REINTERPRETATIONS OF STRUCTURAL ANALYSIS
G. M. L. Gladwell Dec. 1975 36 p refs
(Rept-29; ISSN-0317-7114) Avail: NTIS HC $4.00

Elastic structural analysis is described which does not depend on the principle of superposition or selection of determinate subsystem of an indeterminate structure. The analysis may be extended to structures with nonlinear material behavior. The flexibility method is formulated for structures under applied loads; it is shown that governing equations usually derived by mechanism approach may be reinterpreted in terms of compatible displacement fields of actual structure. Dual formulation for stiffness method for structures with specified deformations is based on equilibrated force fields of actual structure. The procedures are illustrated by two plane frame examples. Author

N76-33551# Naval Civil Engineering Lab., Port Hueneme, Calif.
THEORETICAL RELATIONSHIPS BETWEEN MODULI FOR SOIL LAYERS BENEATH CONCRETE PAVEMENTS Final Report, Jun. 1974 - Mar. 1975
John E. Crawford, Jerome S. Hopkins, and James Smith May 1976 74 p refs
(Contract DOT-FA74WAI-487)
(AD-A028159/2; FAA-RD-75-140) Avail: NTIS HC $4.50 CSCL 13/2

Several mathematical relationships are presented which relate the Westergaard method of analysis used for rigid pavements and the elastic layer method of analysis used for both rigid and flexible pavements. Pavements sections were selected to illustrate the usage of these relationships. These sections represent the widest possible variation of rigid pavement types for which sufficient materials data were available. For the section studied and within the context of linear analysis, these relationships demonstrate that the peak pavement stress can usually be computed by either method of analysis while the peak displacements are separated by a rather consistent seventy percent. Author

N76-33552*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LaRC DESIGN ANALYSIS REPORT FOR NATIONAL TRANSONIC FACILITY FOR 304 STAINLESS STEEL TUNNEL SHELL. VOLUME 1S: FINITE DIFFERENCE ANALYSIS OF CONE/CYLINDER JUNCTION
James W. Ramsey, Jr., John T. Taylor, John F. Wilson, Carl E. Gray, Jr., Anne D. Leatherman, James R. Rooker, and Johnny W. Allred Sep. 1976 137 p
(NASA-TM-X-73957-1) Avail: NTIS HC $6.00 CSCL 13M

The results of extensive computer (finite element, finite difference and numerical integration), thermal, fatigue, and special analyses of critical portions of a large pressurized, cryogenic wind tunnel (National Transonic Facility) are presented. The computer models, loading and boundary conditions are described. Graphic capability was used to display model geometry, section properties, and stress results. A stress criteria is presented for evaluation of the results of the analyses. Thermal analyses were performed for major critical and typical areas. Fatigue analyses of the entire tunnel circuit are presented. Author

N76-33553*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LaRC DESIGN ANALYSIS REPORT FOR NATIONAL TRANSONIC FACILITY FOR 304 STAINLESS STEEL TUNNEL SHELL. VOLUME 2S: FINITE ELEMENT ANALYSIS OF CORNERS NO. 3 AND NO. 4
James W. Ramsey, Jr., John T. Taylor, John C. Wilson, Carl E. Gray, Jr., Anne D. Leatherman, James R. Rooker, and Johnny W. Allred Sep. 1976 96 p refs
(NASA-TM-X-73957-2) Avail: NTIS HC $5.00 CSCL 13M
For abstract, see N76-33552.

N76-33554*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LaRC DESIGN ANALYSIS REPORT FOR NATIONAL TRANSONIC FACILITY FOR 304 STAINLESS STEEL TUNNEL SHELL. VOLUME 3S: FINITE ELEMENT ANALYSIS OF PLENUM REGION INCLUDING SIDE ACCESS REINFORCEMENT, SIDE ACCESS DOOR AND ANGLE OF ATTACK PENETRATION
James W. Ramsey, Jr., John T. Taylor, John F. Wilson, Carl E. Gray, Jr., Anne D. Leatherman, James R. Rooker, and Johnny W. Allred Sep. 1976 203 p
(NASA-TM-X-73957-3) Avail: NTIS HC $7.75 CSCL 13M
For abstract, see N76-33552.

N76-33555*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LaRC DESIGN ANALYSIS REPORT FOR NATIONAL TRANSONIC FACILITY FOR 304 STAINLESS STEEL TUNNEL SHELL. VOLUME 4S: THERMAL ANALYSIS
James W. Ramsey, Jr., John T. Taylor, John F. Wilson, Carl E. Gray, Jr., Anne D. Leatherman, James R. Rooker, and Johnny W. Allred Sep. 1976 147 p
(NASA-TM-X-73957-4) Avail: NTIS HC $6.00 CSCL 13M
For abstract, see N76-33552.

N76-33556*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LaRC DESIGN ANALYSIS REPORT FOR NATIONAL TRANSONIC FACILITY FOR 304 STAINLESS STEEL TUNNEL SHELL. VOLUME 5S: FINITE ELEMENT AND NUMERICAL INTEGRATION ANALYSES OF THE BULKHEAD REGION
James W. Ramsey, Jr., John T. Taylor, John F. Wilson, Carl E. Gray, Jr., Anne D. Leatherman, James R. Rooker, and Johnny W. Allred Sep. 1976 292 p
(NASA-TM-X-73957-5) Avail: NTIS HC $9.25 CSCL 13M
For abstract, see N76-33552.

N76-33557*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LaRC DESIGN ANALYSIS REPORT FOR NATIONAL TRANSONIC FACILITY FOR 304 STAINLESS STEEL TUNNEL SHELL. VOLUME 6S: FATIGUE ANALYSIS
James W. Ramsey, Jr., John T. Taylor, John F. Wilson, Carl E. Gray, Jr., Anne D. Leatherman, James R. Rooker, and Johnny W. Allred Sep. 1976 49 p refs
(NASA-TM-X-73957-6) Avail: NTIS HC $4.00 CSCL 13M
For abstract, see N76-33552.

N76-33558*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LaRC DESIGN ANALYSIS REPORT FOR NATIONAL TRANSONIC FACILITY FOR 304 STAINLESS STEEL TUNNEL SHELL. VOLUME 7S: SPECIAL STUDIES
James W. Ramsey, Jr., John T. Taylor, John F. Wilson, Carl E. Gray, Jr., Anne D. Leatherman, James R. Rooker, and Johnny W. Allred Sep. 1976 36 p refs
(NASA-TM-X-73957-7) Avail: NTIS HC $4.00 CSCL 13M
For abstract, see N76-33552.

N76-33559*# Scientific Translation Service, Santa Barbara, Calif.
STRESSES IN A ROTATING DISK WITH CENTRAL AND NONCENTRAL HOLES
K. Matsusue, A. Nagamatsu, R. Hashimoto, and M. Yonaiyama Washington NASA Sep. 1976 25 p Transl. into ENGLISH "Tasuno Hensing Enko o Yoosuru Kaiden Enpanno Oryuku" Rept. NAL-TR-390, Tokyo, Natl. Aerospace Lab., Oct. 1974 p 1-15 (Contract NASw-2791)
(NASA-TT-F-17189) Avail: NTIS HC $3.50 CSCL 20K
The finite element method is used to calculate distributions of elastic stresses of rotating disks with varying apertures, eccentricities, and centrifugal loads. Author

N76-33560# Blume (John A.) and Associates Research Div., San Francisco, Calif.
STATISTICAL STUDY ON THE STRENGTH OF STRUCTURAL MATERIALS AND ELEMENTS
J. A. Blume, J. S. Dalal, and K. K. Honda Jul. 1975 124 p refs
(Contract AT(26-1)-99)
(JAB-99-118) Avail: NTIS HC $5.45
Strength data for structural materials and elements including concrete, reinforcing steel, structural steel, plywood elements, reinforced concrete beams, reinforced concrete columns, brick masonry elements, and concrete masonry walls were statistically analyzed. Sample statistics were computed for these data, and distribution parameters were derived for normal, lognormal, and Weibull distributions. Goodness-of-fit tests were performed on these distributions. Most data, except those for masonry elements, displayed fairly small dispersion. Dispersion in data for structural materials was generally found to be smaller than for structural elements. Lognormal and Weibull distributions displayed better overall fits to data than normal distribution, although either Weibull or lognormal distribution can be used to represent the data analyzed. Author (NSA)

N76-33561# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
SMALL CONTRIBUTION TO THE TREATMENT OF THE DYNAMIC BEHAVIOR OF A ROTATING SHAFT WITH A CROSS SECTIONAL CRACK [KLEINER BEITRAG ZUR BEHANDLUNG DES DYNAMISCHEN VERHALTENS EINER ROTIERENDEN WELLE MIT ANGERISSENEM QUERSCHNITT]
Robert Gasch 1975 33 p refs In GERMAN; ENGLISH summary
(ILR-8; ISBN-3-7983-0551-X) Avail: NTIS HC $4.00
The dynamic behavior of a rotor with a cross-sectional crack in the shaft was analyzed by introducing a simple crack model. The equations of motion in rotating coordinates are nonlinear but not variable in time. First results of an analog-computer study are given for the influence of the weight and unbalance. Author (ESA)

N76-33562# Institut fuer Festkoerpermechanik, Freiburg (West Germany).
EXPERIMENTAL DETERMINATION OF THE ENERGY DENSITY DISTRIBUTION NEAR CRACK TIPS IN THE CASE OF SUPERPOSED NORMAL AND SHEAR STRESS
J. Riedmueller Aug. 1975 65 p refs In GERMAN; ENGLISH summary
(Contract DFG-So-104/2)
(IFKM-WB-2/75) Avail: NTIS HC $4.50
Isopachic and isochromatic fringe patterns were photographed with the aid of a Mach-Zehnder interferometer to determine the elastic strain energy density around cracks set at various angles to an applied uniaxial tensile stress. These fringe patterns are used to determine the distribution of the sum and the difference of principal stresses on concentric circles around the crack tip. This allows the determination of the strain energy density for the cases of plane stress and plane strain. Results are compared with the energy density distribution calculated by linear elasticity theory. Author (ESA)

N76-33563# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
A SEMIANALYTIC APPROXIMATION METHOD FOR DETERMINATION OF THE NONSTEADY TEMPERATURES IN SKIN-WEB JOINTS [EIN SEMI-ANALYTISCHES NAEHERUNGSVERFAHREN ZUR BESTIMMUNG DER INSTATIONAEREN TEMPERATUREN IN HAUT-STEG-VERBINDUNGEN]
Frank Koehler 1976 107 p refs In GERMAN Sponsored by Deut. Forschungsgemeinschaft
(ILR-10; ISBN-3-7983-0553-6) Avail: NTIS HC $5.00
A semianalytic short term and long term method is described with which the nonsteady temperatures in skin-web joints of supersonic aircraft can be calculated. The time dependence of the adiabatic wall temperature and the heat transfer coefficients are numerically accounted for according to a real flight program. Semianalytic methods have the advantage of producing memory coefficients, which only have to be calculated once and then can be tabulated. The characteristic temperature can be determined without a computer. The usefulness of the approximation method is demonstrated for three different geometries, for which the thermal resistance of a joint between skin and web element can be included in the calculation. The method, exemplified for a supersonic wing, can be transformed to other engineering problems with arbitrary boundary conditions. ESA

N76-33564# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
BUCKLING OF CYLINDRICAL SHELLS UNDER NONUNIFORM LATERAL PRESSURES
Kundurpi S. Prabhu, S. Gopalacharyulu, and D. J. Johns Nov. 1975 278 p refs
(Contract SN/1170/014/NPL)
(TT-7514) Avail: NTIS HC $9.25
Static equilibrium and stability analyses of cylindrical shells subjected to nonuniform external pressures due to wind at high Reynold's numbers and flow of water on submerged cylinders are presented. In the static equilibrium analysis for the prebuckled state both Donnell and Flugge shell theories are employed. The results of prebuckle deformations and stress resultants, when compared with results obtained using beam or semi-membrane theories, show that the beam theory is inadequate and unsafe, whereas the semi-membrane theory is conservative and safe for wind loaded structures. Stability analyses are carried out using both continuum and finite element approaches. The stagnation critical pressures are obtained for various shell geometries and end conditions. Author (ESA)

N76-33565# Oxford Univ. (England). Engineering Lab.
THE EFFECT OF STRAIN RATE ON THE COMPRESSIVE STRENGTH OF A POLYESTER RESIN BASED WOVEN ROVING GLASS FIBRE REINFORCED COMPOSITE Final Report, Jan. 1975
J. Harding and T. Parry Jan. 1976 57 p refs
(Contract AT/2057/058/NCRE)
(OUEL-1141/76) Avail: NTIS HC $4.50

The mechanical behavior of a woven roving glass fiber reinforced polyester composite based material was investigated in axial compression over a wide range of loading rates. Conventional equipment was used for testing at low strain rates while for the intermediate and the high rate tests a hydraulically operated loading machine and a split Hopkinson bar apparatus respectively was used. The testing procedure is described and a detailed analysis of the specimen response is given. Tests were performed on specimens having three different orientations of the compression axis in relation to the fiber direction. A statistical analysis was made to determine the effect of strain rate on the mechanical behavior of the laminate and to ascertain how far the response of the material is affected by change in fiber orientation. Micrographic examination of the deformed specimens was undertaken in an attempt to determine the failure modes for the three different orientations. Author (ESA)

N76-33566# Naval Ship Research and Development Center, Bethesda, Md.
A FULLY STRESSED DESIGN CAPABILITY FOR NASTRAN WITH REANALYSIS TECHNIQUES
Myles Hurwitz and Michael E. Golden Feb. 1976 41 p refs
(SF53532020)
(AD-A023110; DTNSRDC-76-0024) Avail: NTIS CSCL 20/11

A fully stressed design algorithm has been added to NASTRAN level 15 in order to optimize the weight of a structure subject to stress constraints under static loading for isotropic and anisotropic materials. Reanalysis techniques have been included to reduce computer time required for analyzing new designs. These techniques include Taylor series expansion of the displacement vector and a reduced basis method. The derivatives required are computed with respect to either design variables or design variable reciprocals. GRA

N76-33567# Intertech Corp., Iowa City, Iowa.
EXTENSIONS OF AN OPTIMIZATION TECHNIQUE TO FREQUENCY BAND AND THERMAL SYSTEM DESIGN PROBLEMS Final Technical Report, Sep. - Dec. 1975
J. S. Arora, B. M. Kwak, and P. F. Sun Feb. 1976 23 p refs
(Contract DAAA09-75-C-2019)
(AD-A023258) Avail: NTIS CSCL 12/1

In this report, extensions of techniques of structural and mechanical system optimization are considered. Specifically, two problems are considered: (1) structural optimization with constraints on bands of admissible frequencies, and (2) design of thermal systems. In the first problem, the frequency constraints are imposed in such a way that the natural frequencies of the structure do not lie within any prohibited band. This is a very practical problem, and a properly imposed frequency band constraint can avoid catastrophic failure of the system. Sensitivity Analysis for the frequency constraints is developed in the report. The proposed method is applied to a 25 member space truss. In the second problem, optimal design of thermal insulation of a tube is is considered. The problem is first formulated as a finite dimensional nonlinear programming problem and later it is treated as a continuous optimal design problem. The Nusselt number for forced convection at the inner wall is assumed constant to represent the mechanism of heat convection, and an empirical formula for free convection at outer surface is used. The ambient temperature and the inner radius of the tube are assumed to be constant. Author (GRA)

N76-33568# British Steel Corp., Sheffield (England). Information Services.
AN INVESTIGATION INTO THE EFFECT OF ENCLOSED LAMINATION IN LARSSEN SHEET PILE
M. U. Farid Feb. 1976 19 p
(PB-250902/4; GS/PROD/176/22/75/C) Avail: NTIS HC $3.50 CSCL 13M

Stress distribution on laminated and unlaminated enclosed sections was studied. The behavior of enclosed lamination and its effective strength was compared with an unlaminated sheet pile of the same size. Electrical strain gauges were used to measure strain under four point bending tests. In addition to graphical analysis, statistical analysis was used to evaluate the data obtained from the tests. The results show no significant difference between the stresses obtained from enclosed laminated and similar unlaminated sections. GRA

N76-33569# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.
STRUCTURAL INELASTICITY. 13: FINITE ELEMENT MODELS FOR ELASTIC-PLASTIC STRUCTURES
Philip G. Hodge, Jr. Sep. 1975 39 p refs
(Contract N00014-75-C-0177; NR Proj. 064-429)
(AD-A023963; AEM-H1-13) Avail: NTIS CSCL 13/13

It is shown how a consistent finite element model for an elastic-plastic material can be derived by a well-defined sequence of elementary steps. A restricted kinematically admissible field is defined in each generic element and substituted into the internal and external work to lead naturally to appropriate definitions for generalized stresses, strains, and forces. The Principle of Virtual Work then leads to the necessary static relations between the generalized stresses. Finally, elastic-plastic constitutive relations are derived from the expression for internal work and some simplifications are suggested. The theory is illustrated with finite element models for beams, plane strain, plain stress, and torsion. Author (GRA)

N76-33570# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.
STRUCTURAL INELASTICITY. 11: A REVIEW OF SOME PIECEWISE LINEAR THEORIES OF PLASTIC STRAINHARDENING
Philip G. Hodge, Jr. Sep. 1974 42 p refs
(Contract N00014-67-A-0113-0025; NR Proj. 064-429)
(AD-A023964; AEM-H1-11) Avail: NTIS CSCL 13/13

A review is presented of work on piecewise linear plasticity done by the author and his students from 1955 to 1959. A theory for an anisotropic material with 9 material constants is presented and some experiments suggested for determining the constants. Various classical theories may be obtained as special cases. Author (GRA)

N76-33571# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.
STRUCTURAL INELASTICITY. 12: LARGE ROTATIONALLY-SYMMETRIC PLASTIC DEFORMATIONS OF A SANDWICH-TOROIDAL SHELL
Jacek Skrzypek and Philip G. Hodge, Jr. Apr. 1975 41 p refs
(Contract N00014-75-C-0177; NR Proj. 064-429)
(AD-A023965; AEM-H1-12) Avail: NTIS CSCL 13/13

A nonlinear theory of large rotationally-symmetric plastic deformation of a sandwich-toroidal shell has been formulated. The generating curve for the toroid is assumed to be open and of an arbitrary shape. Deformation of the shell, described by the linear Cauchy's measure, is governed by the Love-Kirchhoff hypothesis. On the basis of the principle of virtual work non-linear equations of equilibrium have been derived. The material of the sandwich sheets is assumed to be rigid/perfectly-plastic and to obey the Levy-Mises theory of plastic flow and Huber-Mises-Hencky yield condition. The fundamental equations have been reduced to a system of six, coupled, ordinary, nonlinear differential equations which are, however, linear with respect to the first derivatives of unknown functions. By the use of a numerical procedure the initial/boundary problem can be reduced to a boundary value problem only, for each step of the loading process. Different types of boundary problems as well as continuity requirements have been discussed. Author (GRA)

N76-33572# Sydney Univ. (Australia).
THE BEHAVIOUR OF COMPOSITE BEAMS
N. M. Hawkins and J. W. Roderick Nov. 1975 37 p refs
(PB-252082/3; R-276) Avail: NTIS HC $4.00 CSCL 13M

Tests are described on five composite T-beams, each simply supported and subjected to third point loading on a span of

5.2m. All beams were of the same geometry, the variables included different steels and spacing for the third connectors, the use of normal and lightweight concretes and a range of yield stresses for the steel beams. All beams had an inadequate number of studs in the shear length and the ultimate flexural strengths were therefore determined by this condition. GRA

N76-33573# California Univ., Los Angeles. School of Engineering and Applied Science.
STRESS WAVE GENERATION IN SOLIDS USING A LOW POWER LASER
Joseph Samuel Barker Dec. 1975 81 p refs
(Contract N00014-75-C-0419)
(AD-A022239; UCLA-ENG-7600) Avail: NTIS CSCL 11/2

This thesis is concerned with both the experimental and theoretical aspects of thermally generated stress waves in nondispersive solids. The initial purpose was to determine whether a detectable stress wave could be generated in a solid by exposing a surface to energy from a low power (about 75 watts peak), pulsed solid state laser. Previous experimenters have used high power (= 1 megawatt) lasers to deliver pulses of energy to a sample. The advantages of the solid state laser are its nondestructive nature, safety, size, and cost. Aluminum and glass bars were used as samples, and X-cut quartz transducers were used to detect the stress waves. To increase the absorption of the laser energy, the target surface of each sample was blackened. Thermal stress waves generated due to absorption of laser energy were detected. For comparison with the experimental results, the one dimensional thermoelastic wave equation was solved using impulse response techniques. A theoretical prediction for the shape of the generated stress waves was obtained. GRA

N76-33574# Iowa Univ., Iowa City. Div. of Materials Engineering.
FAIL-SAFE OPTIMAL DESIGN OF STRUCTURES Ph.D. Thesis. Interim Technical Report, Sep. - Dec. 1975
P. F. Sun, J. S. Arora, and E. J. Haug, Jr. Dec. 1975 130 p refs
(Contract DAAA09-76-C-2013)
(AD-A022240; ITR-19) Avail: NTIS CSCL 13/13

A general fail-safe optimal design problem for structures with fixed geometry is formulated in this report. Structural weight or some other performance index can be used as a cost function. Member stress, buckling load, nodal displacement, and natural frequency constraints on the complete and damaged structures are considered. The design variables are size, moment of inertia, or other mechanical properties of structural members. The structure is descretized and a finite element method is used for structural analysis. An iterative algorithm, based on a generalized steepest descent method, is developed to search for optimum designs. In this optimization process, the cost function, state equations, and inequality constraints are linearized and the dependence of these equations on the state variables is eliminated by solving adjoint equations. A fail-safe optimal design problem for a three member truss is solved analytically, to study the properties of fail-safe optimal design problems. A FORTRAN computer program is implemented to solve the fail-safe, minimum weight truss design problem. Structures with three, four, twenty-five, and seventy-two members are treated. GRA

N76-33575# Intertech Corp., Iowa City, Iowa.
OPTIMIZATION OF BEAM TYPE STRUCTURES UNDER DYNAMIC INPUT Final Technical Report, Nov. 1975 - Feb. 1976
T. T. Feng and J. S. Arora Feb. 1976 14 p refs
(Contract DAAA09-75-C-2019)
(AD-A023976; Rept-22) Avail: NTIS CSCL 20/11

This report presents optimal design of cantilever beams subjected to dynamic input. The beams have radial ribs, and the depth of the ribs are considered as design variables. A lumped mass is placed at the free end of the cantilever beams and its effect on the dynamic response is studied. Numerical results for two examples are obtained and discussed. GRA

N76-33576# Naval Civil Engineering Lab., Port Hueneme, Calif.
DYNAMIC RESPONSE OF A HORIZONTALLY BURIED CYLINDER ABOVE A SOIL/ROCK INTERFACE RESULTS OF A FINITE-ELEMENT ANALYSIS Final Report, Sep. 1973 - Sep. 1974
R. N. Murtha Mar. 1976 43 p refs
(DNA Proj. NWED-QAXSC318)
(AD-A024052; CEL-TR-838) Avail: NTIS CSCL 20/11

Static and dynamic two-dimensional finite element computer structural analyses were performed on cylinders, horizontally buried above a rigid concrete bottom (simulating a soil/rock interface), for correlation with laboratory experimental test data. Both linear and nonlinear constitutive models were used to mathematically describe the behavior of the soil medium. A mesh parameter study was performed to optimize mesh size and time increment without degradation of the results. The computer results compared favorably with the experimental data. The reflection of a dynamically applied surface load from the rigid bottom caused soil stress increases of more than twice the incident stress level. These increases were transmitted directly to the cylinder in the form of increased thrusts and moments. Author (GRA)

N76-33577# Kaman Sciences Corp., Colorado Springs, Colo.
THERMOSTRUCTURAL RESPONSE ANALYSIS OF RINGS HEATED BY AN ELECTRON BEAM Final Report
Jon H. Oscarson Nov. 1975 140 p refs
(Contract F29601-74-C-0098)
(AD-A024067; K-75-21U(R); AFWL-TR-75-129) Avail: NTIS CSCL 20/13

The TWORNG Code has been used to calculate the thermostructural response of rings that were shock heated by an electron beam. A total of ten experiments were analyzed, covering a range of four materials: 6061-T6 aluminum, ATJ graphite, Sandia felt carbon-carbon, and AVCO 3D carbon-carbon. Measured and predicted hoop strains were correlated at several locations on each ring. Several good correlations were obtained, indicating that the basic ingredients of ring thermostructural response are properly understood and are being correctly modeled. Predictions of maximum radial displacements and time-dependent temperature profiles were also generated. To aid interpretation of the correlations, an approximate closed-form solution for dynamic ring response to in-depth heating was constructed. The approximate solution is limited to linear elastic materials under half cosine load distributions. Author (GRA)

N76-33578# Louisiana Dept. of Highways, Baton Rouge. Research and Development Section.
RAPID TEST METHODS OF BITUMINOUS MATERIALS Final Report
Donald E. Carey Dec. 1975 39 p refs Sponsored in part by Federal Highway Admin.
(PB-253308/1; RR-99) Avail: NTIS HC $4.00 CSCL 13C

The close agreement found between the standard thin film oven test and the rolling thin film oven test was studied. The correlation between the standard ductility test and a micro-ductility test was examined. The oven comparison was made by testing numerous asphalts for such residual properties as viscosity, penetration, and ductility following exposure in both ovens. A correlation between the standard ductility test and the micro-ductility test is presented, which suggests that a reasonable relationship does exist. However, due to the nature of the resulting correlation, no unique micro-ductility value corresponding to a 100+ ductility value (current Louisiana acceptance specification) can be chosen. Therefore, this test should not be substituted for the well accepted and nationally used standard ductility test. GRA

N76-33579# Massachusetts Inst. of Tech., Cambridge. Constructed Facilities Div.
A STUDY OF THE UNCERTAINTIES IN THE FUNDAMENTAL TRANSLATIONAL PERIODS AND DAMPING VALUES FOR REAL BUILDINGS Research Report, Sep. 1975 - Feb. 1976
Richard Haviland, J. M. Biggs, and E. H. Vanmarcke Feb. 1976 119 p refs
(Contract NSF ATA-74-06935)
(PB-253188/7; R76-12; Rept-5) Avail: NTIS HC $4.50 CSCL 13M

The first step in the seismic safety analysis of buildings is to determine the distribution of responses caused by uncertainty in design ground motion parameters. Further uncertainties due to expected period and damping values will alter the distribution

of responses obtained for a model which is described by deterministic dynamic properties. Data were collected on the fundamental translational periods and damping values for real buildings, by means of a literature survey. Sources of uncertainty are identified and methods to statistically quantify information were investigated. Finally, methodologies are suggested for incorporating the results into the safety analysis. GRA

N76-33580# Alabama State Highway Dept., Montgomery. Bureau of Materials and Tests.
WAX BEADS IN CONCRETE Final Report
F. L. Holman Feb. 1976 36 p refs Prepared in cooperation with the Federal Highway Admin., Washington, D.C.
(PB-253163/0; HPR-77) Avail: NTIS HC $4.00 CSCL 13C

Normal steam curing was studied to determine if wax beads included in a concrete mix design would melt. If not, it was desired to determine if there is an optimum time after steam curing to heat treat the hardened concrete to melt the wax beads. Fifty concrete cylinders containing 3% by weight of wax beads and twenty control cylinders were prepared, steam cured, and subjected to various tests in the laboratory. The normal steam curing process does not melt the wax beads. The inclusion of wax beads in the concrete resulted in lowered compressive strengths of the test cylinders. GRA

N76-33581# Texas Univ., Austin.
MODIFICATION AND IMPLEMENTATION OF THE RIGID PAVEMENT DESIGN SYSTEM Interim Report
Robert F. Carmichael and B. F. McCullough Jan. 1975 229 p refs Sponsored in part by Federal Highway Admin. and Texas Highway Dept., Austin
(PB-251204/4; CFHR-1-8-69-123-26; FHWA-RD-76-S0450) Avail: NTIS HC $8.00 CSCL 13B

A revised rigid pavement system computer program, RPS-3, is presented and documented. Changes were made in the traffic delay cost subroutine. The program's modularization is outlined and each new subroutine is flow charted and explained. A discussion of RPS-3 implementation is also included. A complete set of sample RPS-3 problems and a complete input guide as well as a discussion of the most common errors encountered in the use of RPS-3 is contained. This report is also intended to be a user's manual for the RPS-3 program. GRA

N76-33582# Minnesota Dept. of Highways, St. Paul. Office of Research Coordination.
EVALUATION OF SOLID WASTE MATERIALS FOR HIGHWAY USES Final Report
R. O. Wolters and R. H. Cassellius 1975 40 p refs
(PB-253609/2; Investigation-638; MN-HW-5-180-75-4) Avail: NTIS HC $4.00 CSCL 13C

The utilization of solid waste material for road construction and maintenance was studied. Waste materials in Minnesota available in large quantities are taconite tailings, fly ash and boiler slag. Some of the successful uses found for these products are embankment fill, subbase, base stabilizer for soil or aggregate, paving aggregate, and bituminous mix components. GRA

N76-33583# California Univ., Berkeley. Earthquake Research Center.
EFFICIENT FINITE ELEMENT ANALYSIS OF SEISMIC STRUCTURE-SOIL-STRUCTURE INTERACTION
J. Lysmer, H. Bolton Seed, T. Udaka, R. N. Hwang, and C. F. Tsai Nov. 1975 31 p refs
(Grant NSF GI-43104)
(PB-253570/6; EERC-75-34) Avail: NTIS HC $4.00 CSCL 13M

The use of finite element techniques for the performance of complete interaction analyses is discussed, and an efficient procedure which meets all desirable requirements without incurring excessive costs for design and analysis is described. GRA

N76-33584# Effects Technology, Inc., Santa Barbara, Calif.
HTGR FRACTURE TOUGHNESS PROGRAM Final Report
R. A. Wullaert, J. W. Sheckherd, W. L. Server, and W. Oldfield Apr. 1976 247 p refs
(PB-253481/6; EPRI-NP-120) HC $8.00 CSCL 18J

The program was performed to provide sufficient fracture toughness data for typical production heats of high temperature gas cooled reactor (HTGR) materials to determine the adequacy of the ASME pressure vessel code curve of HTGR applications. The HTGR test program included mechanical tests such as tensile, Charpy V-notch, instrumented precracked Charpy, static and dynamic compact fracture, and dynamic three-point bend tests. Five heats of HTGR materials were tested over the temperature range of -200 F to +550 F. Mill test reports and welding history, metallography, chemistry, archive and specimen drawings are included. All fracture toughness data generated for the HTGR materials fell above the ASME pressure vessel code curve, except at very low temperatures which are not representative of service conditions. GRA

N76-33585# J. G. Engineering Research Associates, Baltimore, Md.
ENERGY APPROACHES TO STRUCTURAL VULNERABILITY WITH APPLICATION OF THE NEW BELL STRESS-STRAIN LAWS
Joshua E. Greenspon Mar. 1976 62 p refs
(Contract DAAD05-75-C-0731)
(AD-A022478; BRL-CR-291) Avail: NTIS CSCL 20/11

This report summarizes the various ways in which energy absorbed by a structure can be used in vulnerability studies. Three approaches are explained and mathematical relationships given for each. An extensive presentation is given of a simplified variational approach with applications shown for beams and plates. Finally the new Bell Stress-Strain Laws are applied to compute energy and plastic deformation in beams and plates. Author (GRA)

42 GEOSCIENCES (GENERAL)

N76-33586*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ADVANCED MULTILATERATION THEORY, SOFTWARE DEVELOPMENT, AND DATA PROCESSING: THE MICRODOT SYSTEM
P. R. Escobal, J. F. Gallagher (Computer Sciences Corp.), and O. H. VonRoos 4 Jul. 1976 459 p refs
(Contract NAS7-100)
(NASA-CR-148839; JPL-TM-33-792) Avail: NTIS HC $12.00 CSCL 08G

The process of geometric parameter estimation to accuracies of one centimeter, i.e., multilateration, is defined and applications are listed. A brief functional explanation of the theory is presented. Next, various multilateration systems are described in order of increasing system complexity. Expected systems accuracy is discussed from a general point of view and a summary of the errors is listed. An outline of the design of a software processing system for multilateration, called MICRODOT, is presented next. The links of this software, which can be used for multilateration data simulations or operational data reduction, are examined on an individual basis. Functional flow diagrams are presented to aid in understanding the software capability. MICRODOT capability is described with respect to vehicle configurations, interstation coordinate reduction, geophysical parameter estimation, and orbit determination. Numerical results obtained from MICRODOT via data simulations are displayed both for hypothetical and real world vehicle/station configurations such as used in the GEOS-3 Project. These simulations show the inherent power of the multilateration procedure. Author

N76-33587# National Oceanic and Atmospheric Administration, Rockville, Md.
INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES
Feb. 1976 108 p refs
(PB-253928/6; IFYGL-Bull-17; NOAA-76030306) Avail: NTIS HC $5.50 CSCL 08H

A bibliography of articles, project reports, abstracts, and program tasks published by scientists from the United States and Canada whose studies are based on environmental research in the Great Lakes is presented. GRA

N76-33588# Oak Ridge National Lab., Tenn.
NATIONAL ENVIRONMENTAL SPECIMEN BANK SURVEY

Final Report, Jun. - Jul. 1975
R. I. VanHook and E. E. Huber Jan. 1976 213 p Sponsored in part by NSF, Washington, D. C.
(PB-251180/6; EPA-600/1-76-006) Avail: NTIS HC $7.75 CSCL 05B

The data base developed in the National Environmental Specimen Bank (NESB) Survey is presented. The mailing list consisted of 4500 names and addresses. The 657 environmental specimen collections that were located and documented include the following categories: animal, atmospheric geological, microbiological, plant and water. The majority of the collections identified are biological in nature. Three indexes of the NESB Survey Data Base are included. GRA

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N76-33589* + National Aeronautics and Space Administration, Washington, D.C.
EARTH RESOURCES: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 9
Jun. 1976 107 p refs
(NASA-SP-7041(09)) Avail: NTIS HC $4.00 CSCL 05B

This bibliography lists 418 reports, articles, and other documents introduced into the NASA scientific and technical information system between January 1976 and March 1976. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis. Author

N76-33590*# Kentucky Dept. of Natural Resources and Environmental Protection, Frankfort.
[ENVIRONMENTAL EFFECTS OF STRIP MINING] Quarterly Progress Report, 21 Nov. 1975 - 21 Feb. 1976
Birny R. Fish, Principal Investigator 21 Feb. 1976 5 p Sponsored by NASA ERTS
(E76-10481; NASA-CR-148788; QPR-4) Avail: NTIS HC $3.50 CSCL 05B

There are no author-identified significant results in this report.

N76-33591*# Army Construction Engineering Research Lab., Champaign, Ill.
EFFECTS OF CONSTRUCTION AND STAGED FILLING OF RESERVOIRS ON THE ENVIRONMENT AND ECOLOGY Progress Report, 1 Jul. - 30 Sep. 1976
R. K. Jain, Principal Investigator 21 Oct. 1976 7 p ERTS
(E76-10498; NASA-CR-148753) Avail: NTIS HC $3.50 CSCL 08H

There are no author-identified significant results in this report.

N76-33592*# Northern Prairie Wildlife Research Center, Jamestown, N. Dak.
APPLICATION OF LANDSAT SYSTEM FOR IMPROVING METHODOLOGY FOR INVENTORY AND CLASSIFICATION OF WETLANDS Progress Report, 1 Jul. - 30 Sep. 1976
David S. Gilmer, Principal Investigator and Edgar A. Work, Jr. 8 Oct. 1976 8 p ref ERTS
(NASA Order S-54049-A)
(E76-10503; NASA-CR-148823) Avail: NTIS HC $3.50 CSCL 08B

The author has identified the following significant results. Thematic maps were produced for surface water in stratum 46. The presence of large amounts of surface water, particularly during the May period, is readily apparent in the photoreduced thematic maps. Sheet water comprises much of the water detected in the May scene. Spring sheet water tends to be ephemeral and occurs as a result of an ice seal which exists within the underlying soil, temporarily preventing the percolation of water. The abundance of water in the May scene is also a result of unusually heavy precipitation which occurred during the spring and the previous fall. A qualitative analysis of the July map indicates surface water is less abundant than during the previous May; however, surface water present in the July 1975 LANDSAT scene was unusually abundant compared to other midsummer LANDSAT scenes obtained since 1972. This condition was particularly apparent for the drift plain.

N76-33593# Spangle (William) and Associates, Portola Valley, Calif.
EARTH-SCIENCE INFORMATION IN LAND-USE PLANNING: GUIDELINES FOR EARTH SCIENTISTS AND PLANNERS
1976 34 p refs Sponsored in part by USGS and HUD Prepared in cooperation with Leighton (F. Beach) and Associates; and Baxter, McDonald and Company
(USGS-Circ-721) Avail: NTIS HC $4.00

A set of general guidelines for utilizing earth science information (ESI) in land use planning is presented. The types and sources of ESI available and techniques for applying it to planning are discussed. The requirements of planners and how ESI can be made more useful to them are also defined. D.M.L.

N76-33594*# Systems Control, Inc., Palo Alto, Calif.
USER DATA DISSEMINATION CONCEPTS FOR EARTH RESOURCES: EXECUTIVE SUMMARY
R. Davies, M. Scott, C. Mitchell, and A. Torbett Jun. 1976 56 p refs Prepared in cooperation with Aeronutronic Ford Corp., Palo Alto, Calif.
(Contract NAS2-8964)
(NASA-CR-137904; WDL-TR-7187A) Avail: NTIS HC $4.50 CSCL 05B

The impact of the future capabilities of earth-resources data sensors (both satellite and airborne) and their requirements on the data dissemination network were investigated and optimum ways of configuring this network were determined. The scope of this study was limited to the continental U.S.A. (including Alaska) and to the 1985-1995 time period. Some of the conclusions and recommendations reached were: (1) Data from satellites in sun-synchronous polar orbits (700-920 km) will generate most of the earth-resources data in the specified time period. (2) Data from aircraft and shuttle sorties cannot be readily integrated in a data-dissemination network unless already preprocessed in a digitized form to a standard geometric coordinate system. (3) Data transmission between readout stations and central preprocessing facilities, and between processing facilities and user facilities are most economically performed by domestic communication satellites. (4) The effect of the following factors should be studied: cloud cover, expanded coverage, pricing strategies, multidiscipline missions. Author

N76-33595*# Systems Control, Inc., Palo Alto, Calif.
USER DATA DISSEMINATION CONCEPTS FOR EARTH RESOURCES Final Report
R. Davies, M. Scott, C. Mitchell, and A. Torbett Jun. 1976 254 p refs Prepared in cooperation with Aeronutronic Ford Corp., Palo Alto, Calif.
(Contract NAS2-8964)
(NASA-CR-137905; WDL-TR-7187) Avail: NTIS HC $9.00 CSCL 05B

Domestic data dissemination networks for earth-resources data in the 1985-1995 time frame were evaluated. The following topics were addressed: (1) earth-resources data sources and expected data volumes, (2) future user demand in terms of data volume and timeliness, (3) space-to-space and earth point-to-point transmission link requirements and implementation, (4) preprocessing requirements and implementation, (5) network costs, and (6) technological development to support this implementation. This study was parametric in that the data input (supply) was varied by a factor of about fifteen while the user request (demand) was varied by a factor of about nineteen. Correspondingly, the time from observation to delivery to the user was varied. This parametric evaluation was performed by a computer simulation that was based on network alternatives and

resulted in preliminary transmission and preprocessing requirements. The earth-resource data sources considered were: shuttle sorties, synchronous satellites (e.g., SEOS), aircraft, and satellites in polar orbits. Author

N76-33596*# Systems Control, Inc., Palo Alto, Calif.
USER DATA DISSEMINATION CONCEPTS FOR EARTH RESOURCES, APPENDIXES Final Report
Jun. 1976 231 p refs Prepared in cooperation with Aeronutronic Ford Corp., Palo Alto, Calif.
(Contract NASw-8964)
(NASA-CR-137910; WDL-TR-7187-App) Avail: NTIS HC $8.00 CSCL 05B

A number of appendices were presented, dealing with the following topics: (1) a summary of the recommendations for spectral band location from six studies and for six disciplines. (2) demonstration of the LANDSAT scenes required for a satellite of 18-day repeat cycle, and comparison of the data volume associated with scene transmission with the data volume based on length-of-swath estimates, (3) presentation of a sample of the potential user demand projected based on polar orbiter passes over Conus and Alaska, (4) presentation of the nominal and expanded user demands for both Conus and Alaska, (5) derivation of a mathematical relation, (6) tables giving cost calculations for certain data points, (7) prssentation of the UOT G/T and link budgets for leased-transponder transmission alternative, and (8) flow charts of the simulation program. Y.J.A.

N76-33597*# Geological Survey, Denver, Colo.
APPLICATIONS OF SKYLAB EREP PHOTOGRAPHS TO MAPPING LANDFORMS AND ENVIRONMENTAL GEOMORPHOLOGY IN THE GREAT PLAINS AND MIDWEST Final Report, 1 Jan. 1974 - 15 Aug. 1975
Roger B. Morrison, Jerry A. Lineback (Ill. State Geol. Survey), H. Kit Fuller, and Richard K. Rinkenberger 15 Aug. 1975 125 p refs
(NASA Order T-4647-B)
(NASA-CR-144491; EREP-491) Avail: NTIS HC $5.50 CSCL 08B

The following evaluations of Skylab photographs were undertaken: (1) the 1290 Skylab S190A and S190B photographs of Illinois, Iowa, Kansas, Missouri, Nebraska, and South Dakota were evaluated in detail in terms of coverage, cloud cover, photographic quality, endlap, detectability of roads and stereorelief, and utility for geomorphologic mapping, and (2) the utility of the Skylab photos were tested for interpretive analytic mapping of geomorphologic features over large areas representative of different parts of this region. Photointerpretative maps of analytic geomorphology were obtained for various test areas representative of the varied landscapes in the region. These maps are useful for regional land-use planning, ground-water exploration, and other environmental geomorphologic-geologic applications. Compared with LANDSAT-1 MSS images, Skylab photos afford almost as extensive overviews of large areas but in considerably greater detail, and for many SL photos, moderate stereorelief. However, repetitive multiseasonal, cloud-free coverage by high-quality photos is very limited and many areas have no coverage at all. Author

N76-33598*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
DOCUMENTATION OF PROCEDURES FOR TEXTURAL/SPATIAL PATTERN RECOGNITION TECHNIQUES Final Report
Robert M. Haralick and William F. Bryant 15 Apr. 1976 219 p refs
(Contract NAS9-14453)
(NASA-CR-150995; RSL-TR-278-1) Avail: NTIS HC $7.75 CSCL 02F

A C-130 aircraft was flown over the Sam Houston National Forest on March 21, 1973 at 10,000 feet altitude to collect multispectral scanner (MSS) data. Existing textural and spatial automatic processing techniques were used to classify the MSS imagery into specified timber categories. Several classification experiments were performed on this data using features selected from the spectral bands and a texturai transform band. The results indicate that (1) spatial post-processing a classified image can cut the classification error to 1/2 or 1/3 of its initial value, (2) spatial post-processing the classified image using combined spectral and textural features produces a resulting image with less error than post-processing a classified image using only spectral features and (3) classification without spatial post processing using the combined spectral textural features tends to produce about the same error rate as a classification without spatial post processing using only spectral features. Author

N76-33599*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
MESOSCALE TEMPERATURE AND MOISTURE FIELDS FROM SATELLITE INFRARED SOUNDINGS
Donald W. Hillger and Thomas H. VonderHaar May 1976 75 p refs Presented at COSPAR Symp. on Meteorological Observations from Space, Jun. 1976 Sponsored in part by Bureau of Reclamation
(Grant NGR-06-002-102)
(NASA-CR-148993; ASP-249) Avail: NTIS HC $4.50 CSCL 04A

The combined use of radiosonde and satellite infrared soundings can provide mesoscale temperature and moisture fields at the time of satellite coverage. Radiance data from the vertical temperature profile radiometer on NOAA polar-orbiting satellites can be used along with a radiosonde sounding as an initial guess in an iterative retrieval algorithm. The mesoscale temperature and moisture fields at local 9 - 10 a.m., which are produced by retrieving temperature profiles at each scan spot for the BTPR (every 70 km), can be used for analysis or as a forecasting tool for subsequent weather events during the day. The advantage of better horizontal resolution of satellite soundings can be coupled with the radiosonde temperature and moisture profile both as a best initial guess profile and as a means of eliminating problems due to the limited vertical resolution of satellite soundings. Author

N76-33600# Oak Ridge National Lab., Tenn.
DEFINING OF INDUSTRIAL LOCATION CRITERIA AT THE SITE LEVEL: AN EMPIRICAL ANALYSIS USING AERIAL PHOTOGRAPHY
R. B. Honea 1975 34 p refs Presented at Proc. of Am. Soc. of Photogrammetry, Phoenix, Ariz., 26 Oct. 1975 Sponsored by ERDA
(CONF-751064-2) Avail: NTIS HC $5.00

The advantages of aerial photography in the selection of industrial sites are discussed. Applications in the regional analysis of land use for a 6,500 square mile area in East Tennessee are presented. ERA

N76-33601# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
RADIOGLACIOLOGY: SOUNDINGS NEAR ISUA, SOUTHWEST GREENLAND
P. Gudmandsen, N. Skou, and F. Soendergaa.d Oct. 1974 31 p Sponsored in part by Min. for Greenland, Danish Natl. Sci. Res. Found., and NSF
(TUD-D-224) Avail: NTIS HC $4.00

Radio echo sounding data obtained near the iron ore deposit at Isua, Greenland, from 1971 to 1972 are presented. The soundings were carried out in late September, mid-April, and late July, respectively. In the area south and east of Isua, bedrock echoes were obtained. Ice thicknesses in the order of 700 were measured 12 km northeast of the iron ore deposit, while no bedrock echoes were detected in the area northwest of Isua. Further sounding is suggested. At the surface a new low-frequency technique may be useful in the area northwest of Isua. Ice velocity measurements may be carried out using radio echo sounding techniques but other types of measurements may be more direct since reference points on ice free areas are accessible. ESA

N76-33602# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
RADIOGLACIOLOGY Annual Report, 1974
May 1975 22 p Sponsored in part by Danish Natl. Sci. Res. Council, Min. for Greenland, NSF, and Space Comm. of the Danish Res. Admin.
(TUD-D-253) Avail: NTIS HC $3.50

A review of the remote sensing activities in Greenland carried

out by the Electromagnetics Institute during the calendar year 1974 is given including radio echo sounding of the ice surface at Dye-3 radar station, airborne sounding, radiometer investigations, and plans for 1975. Future work is discussed. Publications in 1974 are listed. ESA

N76-33603# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
RADIOGLACIOLOGY: SURFACE SOUNDINGS NEAR DYE-3
Finn Soendergaard Feb. 1975 32 p refs Sponsored in part by NSF and by Min. for Greenland
(TUD-D-258) Avail: NTIS HC $4.00

As a part of the 1974 Greenland Ice Sheet Program, radioglaciological investigations were carried out from the ice surface in the vicinity of the DYE-3 station (65 deg 11' N and 43 deg 50' W) in the periods May 7 to May 18 and June 11 to June 12. Radio echo soundings from the ice surface along lines in a 25 km vicinity of the DYE station were carried out. A 60 MHz radar system was installed on three sledges and pulled behind a Trackmaster. Continuous bedrock echoes were obtained from which ice thickness profiles were produced. Small echoes were detected from layers in the ice that take the form of bedrock. Soundings along the strain network show correlation between bedrock and the surface topography. Crosspolarization measurements revealed signs of anisotropy in the ice. ESA

N76-33604# Technische Universitaet, Brunswick (West Germany). Inst. fuer Chemische Technologie.
LITERATURE STUDY OF OIL SHALE Final Report [LITERATURSTUDIE OELSCHIEFER]
Hans Kroepelin and Johanna Ober-Sundermeyer Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1975 232 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol
(BMFT-FB-T-75-50) Avail: NTIS HC $8.00; ZLDI, Munich DM 48.75

A literature search covering all the available information on oil shale through the 1975 summer is presented. Oil shale deposits and the economic feasibilities within the scope of mineral oil exploration are discussed. The oil shale deposits in the Federal Republic of Germany are described, and efforts made between 1930 and 1945 in connection with oil shale utilization are illustrated. European and overseas deposits are dealt with and, in addition, facts are given concerning tar sands, lignite and carbonaceous shales, and torbernite. The properties of the different oil shales in the Federal Republic of Germany and those of worldwide deposits are specified in tables showing in detail the chemical composition, caloric value, and methods for isolating the organic substances. All known processes of low-temperature distillation, gasification, and degasification of oil shale are mentioned, as well as processes for the thermal treatment, underground low-temperature distillation, and other distillation methods. Author (ESA)

N76-33605# Naval Research Lab., Washington, D.C.
A PROGRAM TO PLOT AN ANNOTATED TRACK OR A TRACK AND BATHYMETRY OR MAGNETIC PROFILE ON A MERCATOR PROJECTION Final Report
Marilyn L. Blodgett and James V. Massingill 27 Feb. 1976 42 p
(ARPA Order 1787; NRL Proj. S01-47; ZF52552001)
(AD-A022031; NRL-7930) Avail: NTIS CSCL 09/2

A program has been written for plotting an annotated track or for plotting a track and the superimposed bathymetry or magnetic profile on a Mercator projection. The program reads the data (navigation, bathymetry, or magnetics) from a magnetic tape in BCD form. The program will annotate every point or every nth point. Navigation is annotated with fix numbers, bathymetry with uncorrected fathoms, meters, or corrected meters, and magnetics with the residual magnetic intensity. The profile series is plotted perpendicular to the track, using uncorrected fathoms or meters for bathymetry and residual magnetic intensity for magnetics. The program was written in FORTRAN IV for use on a CDC 3800 computer; however, the program can be converted to run on other systems with little difficulty.
Author (GRA)

N76-33606# Naval Research Lab., Washington, D.C.
A PROGRAM TO PLOT A TRACK AND BATHYMETRY OR MAGNETIC PROFILE ON A POLAR STEREOGRAPHIC PROJECTION Final Report
Marilyn L. Blodgett and James V. Massingill 27 Feb. 1976 37 p
(ARPA Order 1787; NRL Proj. S01-47; ZF52552001)
(AD-A022032; NRL-7929) Avail: NTIS CSCL 09/2

A program has been written for plotting a track and the superimposed bathymetry or magnetic profile on a polar stereographic projection. This profile series is plotted perpendicular to the track, using uncorrected fathoms or meters for bathymetry and residual magnetic intensity for magnetics. The program was written in FORTRAN IV for use on a CDC 3800 Computer; however, the program can be converted to run on other systems with little difficulty. Author (GRA)

N76-33607# Inter-American Tropical Tuna Commission, La Jolla, Calif.
USE OF ERTS (MSS) AND NOAA VHRR DATA IN MARINE RESOURCE ASSESSMENT
Merritt R. Stevenson, Forrest R. Miller, and Robert G. Kirkham Dec. 1975 112 p refs
(Grant NOAA-04-5-158-56)
(PB-252551/7; NOAA-76022602) Avail: NTIS HC $5.50 CSCL 08J

Results on the feasibility of using cloud top temperatures from infrared satellite sensors to estimate sea surface temperatures off California and Baja California are described. Findings suggest that statistically significant relations may exist when stratus clouds overlay the surface for periods of several days. Other research in evaluating ERTS-1 MSS imagery for ocean color is also described. Computer programs were developed for a number of purposes, including a procedure to accurately grid MSS digital imagery using an inexpensive line printer method. A statistical analysis of noise characteristics of MSS detectors was made and a method was devised to reduce this noise in the MSS data. Preliminary analysis of ocean color gradients is also discussed. GRA

N76-33608# Colorado State Univ., Fort Collins. Environmental Resources Center.
MANUAL FOR TRAINING IN THE APPLICATION OF THE PRINCIPLES AND STANDARDS OF THE WATER RESOURCES COUNCIL
Dec. 1974 528 p refs
(Contracts DI-14-31-0001-4260; DI-14-31-0001-4242; Proj. X-143; Proj. C-5345)
(PB-250959/4; W76-05348; OWRT-C-5345(4242)) Avail: NTIS HC $13.00 CSCL 05I

Materials for the conduct of training courses are set forth. Principles and Standards relate directly to Federal water resources planning but state and local agencies and private firms need to understand their application to Federal and Federally assisted projects. Levels of planning are identified: Framework studies and assessment which deal with major policy decisions; regional or river basin plans; and implementation studies. The Principles apply at all levels but the components of objectives will be specified differently though in a manner providing insights about tradeoffs among alternatives. The planning process is visualized in 5 steps. GRA

N76-33609# Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
PROCEEDINGS OF CONFERENCE ON WATER CONSERVATION AND SEWAGE FLOW REDUCTION WITH WATER-SAVING DEVICES
William E. Sharpe and Peter W. Fletcher Jul. 1975 212 p refs Held at Pa. State Univ. 8-10 Apr. 1975
(Contract DI-14-31-0001-4038)
(PB-250999/0; Information-74; W76-05602; OWRT-A-038-PA(1)) Avail: NTIS HC $7.75 CSCL 13B

These proceedings are a current state-of-the-art assessment of water-saving device technology in the United States. The papers address themselves to the major questions associated with water-saving device development and use. The gaps in current knowledge are enumerated and the information necessary to fill these gaps is identifed. The information contained in these

proceedings will be of benefit to a broad spectrum of concerned individuals from the researchers to the facilities manager. Water conservation will be a definite part of America's future and water-saving devices have already begun to take their place in this conservation effort. GRA

N76-33610# Development and Resources Transportation Co., Silver Spring, Md.
CORRELATION OF DUAL-CHANNEL AIRBORNE IR DATA WITH SOIL MOISTURE MEASUREMENTS Final Report
Leonard A. LeSchack, Nancy Kerr DelGrande, Sam I. Outcalt, John Lewis, and Carol Tenner May 1975 71 p refs
(Grant NOAA-4-35308)
(PB-251190/5; NOAA-76021302) Avail: NTIS HC $4.50 CSCL 08H

Cluster analysis was used to divide the raw radiant emittance data into two distinct groups to show that a positive correlation existed among the soil-moisture-radiant emittance data. Regression analysis thereupon showed significant positive correlations. Corrected surface temperature data were compared with calculated values obtained using a Digital Surface-Climate Simulator Model. Additionally, a 'Student Paired-t Test' showed that both observed and simulated temperature data came from the same statistical population. The implication is that the model is a useful tool for estimating the effect of soil moisture on the energy radiated from the surface. GRA

N76-33611# Geological Survey, Denver, Colo. Conservation Div.
SELECTED GEOTHERMAL RESOURCES DATA: HYDROTHERMAL CONVECTION SYSTEMS IN THE STATES OF ALASKA, ARIZONA, CALIFORNIA, COLORADO, HAWAII, IDAHO, MONTANA, NEVADA, NEW MEXICO, OREGON, UTAH, WASHINGTON, AND WYOMING Final Data to Jun. 1975
J. L. Renner Feb. 1976 358 p refs Sponsored in part by ERDA
(PB-250377/9; USGS-CD-76-001; CRPU-76-16) Avail: NTIS HC $10.50 CSCL 08G

Data collected as part of the U.S. Geological Survey's research and land classification programs, from professional publications, and industry sources were compiled in computer format. Location, surface manifestations, chemistry, physical properties, exploratory and development work, and references pertinent to 290 hydrothermal convection systems comprise the data base. GRA

N76-33612# Westinghouse Research Labs., Pittsburgh, Pa.
THERMODYNAMICS OF SALT SOLUTIONS AND GEOTHERMAL BRINES AT ELEVATED TEMPERATURES Final Report Jun. 1972 - Mar. 1975
Chia-Tsun Liu Mar. 1975 81 p refs
(Contract DI-14-30-2918)
(PB-250733/3; W76-05244; OWRT-S-76-19) Avail: NTIS HC $5.00 CSCL 07D

Vapor pressure lowering measurements of synthetic geothermal brines were carried out at temperatures from 75 to 250C with three concentrations ranging from one- to four-fold concentrates of hot-water type geothermal chemical systems. Osmotic coefficients and boiling point elevations of the brine solutions were obtained; these were compared with data for sodium chloride and for saline water concentrates. The results are discussed in terms of the structural aspect of ion-solvent interaction and ion association. GRA

N76-33613# Kellogg (M. W.) Co., Piscataway, N.J.
SALINE WATER CONVERSION ENGINEERING DATA BOOK, 1975
Oct. 1975 717 p refs
(Contract DI-14-30-3121)
(PB-250907/3; OWRT-S-76-1; W76-05347) Avail: NTIS HC $18.75 CSCL 07A

Information is presented on physical properties of chemicals and selected materials, derived thermodynamic data, phase equilibria, equipment cost and economic factors, design methods, and standards for saline water conversion. Sample calculations on pressure drop in two phase flow, and process flow diagrams for distillation, freezing, reverse osmosis, and electrodialysis are included. Design of seawater deaerators, liquid-liquid spray towers, and seawater chemistry are discussed. GRA

N76-33614# Office of Technology Assessment, Washington, D.C.
AN ANALYSIS OF THE DEPARTMENT OF THE INTERIOR'S PROPOSED ACCELERATION OF DEVELOPMENT OF OIL AND GAS ON THE OUTER CONTINENTAL SHELF. COMMITTEE PRINT
5 Mar. 1975 42 p refs
(PB-252202/7) Avail: NTIS HC $4.00 CSCL 08I

Recurring issues are addressed: (1) longer term resource and energy implications, (2) the effect of acceleration on revenue returns from the sale of public lands, (3) industrial capacity to explore 10 million acres proposed for development, and (4) the impact on the adjacent coastal states which have no previous experience or supporting onshore infrastructure. GRA

N76-33615# Pennsylvania State Univ., University Park. Coll. of Earth and Mineral Sciences.
CHARACTERIZATION OF MINERAL MATTER IN COALS AND COAL LIQUEFACTION RESIDUES Annual Report
P. L. Walker, Jr., W. Spackman, P. H. Given, E. W. White, A. Davis, and R. G. Jenkins Dec. 1975 111 p refs Sponsored by Elec. Power Res. Inst.
(PB-252256/3; EPRI-366-1) Avail: NTIS HC $5.50 CSCL 08I

The mineral matter and the organic fractions of coals and liquefaction residues were chemically analyzed. Correlations were then sought between the composition and properties of these materials and specific liquefaction process phenomena. Characterization techniques employed include: (1) reflectance of organic and inorganic fractions in incident light; (2) light microscopy; (3) computer evaluation of scanning electron microscope images; (4) infrared spectroscopy; (5) X-ray diffraction; (6) sedimentation; surface areas from gas absorption; (7) helium densities; (8) magnetic measurements and (9) transmission electron microscopy. GRA

N76-33616# National Academy of Sciences - National Research Council, Washington, D.C.
NUCLEAR TECHNIQUES IN HYDROLOGY: CURRENT STATUS AND PROSPECTIVE USES. A REPORT OF THE WORK GROUP ON NUCLEAR TECHNIQUES IN HYDROLOGY OF THE US NATIONAL COMMITTEE FOR THE INTERNATIONAL HYDROLOGICAL DECADE Final Report
1975 53 p refs
(Contract NSF C-310)
(PB-253154/9; LC-75-27456) Avail: NTIS HC $4.50 CSCL 08H

Nuclear techniques are underutilized in hydrology because the use of non-nuclear techniques is well established, and many hydrologists are unfamiliar with nuclear techniques and their possibilities. The preparation and wide distribution of an authoritative reference and the establishment of a scheduled program of short courses are suggested to correct this situation. Applications of nuclear techniques (radioactive isotopes) to hydrology are discussed in terms of available techniques, the hydrological problems to which the techniques can be applied, and some professional problems. GRA

N76-33617# National Academy of Sciences - National Research Council, Washington, D.C.
CATALOG OF UNITED STATES CONTRIBUTIONS TO THE INTERNATIONAL HYDROLOGICAL DECADE, 1965 - 1974 Final Report
1975 274 p refs
(PB-253155/6; LC-75-21873) Avail: NTIS HC $9.00 CSCL 08H

The contributions of U.S. scientists and agencies to the International Hydrological Program in 39 major categories of hydrological activities are summarized. A total of 159 projects are described. Information on projects generally provides name, investigating organization, principle investigator, objectives, results achieved, and list of publically available reports. The report also is indexed by subject, principal investigator, and organization. GRA

N76-33618*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE SNOW OBSERVATIONS AND SEASONAL STREAMFLOW FORECASTS Final Report
A. Rango and V. V. Salomonson Jan. 1976 26 p refs
(Contract NOAA-NA-776-74)
(NASA-TM-X-73009; PB-254251/2; NOAA-76031501) Avail: NTIS HC $4.00 CSCL 08H

Relatively low spatial resolution (about 4 km) environmental satellite and high spatial resolution (80m) earth resources satellite data were used to map snow covered areas occurring in the upper Indus River Basin in Pakistan and the Wind River Mountains in Wyoming. For the Indus River, early Spring snow covered area measurements were obtained and compared to April through June total stream flow during the years 1967-1971. A linear regression equation quantitatively expressing the relationship had an (r squared) = 0.91. Prediction of the April-June 1972 stream flow using this equation produced an estimate that was within three percent of the actual total. GRA

N76-33619# Kentucky Water Resources Inst., Lexington.
SUPPLY AND DEMAND IN WATER PLANNING: STREAMFLOW ESTIMATION AND CONSERVATIONAL WATER PRICING
D. I. Carey and C. T. Haan Jan. 1976 190 p refs
(Contracts DI-14-31-0001-4017; DI-14-31-0001-5017)
(PB-251159/0; RR-92; W76-05607; OWRT-A-052-KY(2)) Avail: NTIS HC $7.50 CSCL 13B

Methods in water supply reservoir design that increase system benefits were provided. Two major factors influencing reservoir design were studied: estimated future streamflow into the reservoir, and demands placed on the reservoir. A methodology was presented to evaluate the ability of a parametric model to improve the stochastic model parameter estimates. A modified Markov Chain model was proposed which used continuous distributions to present the process when rainfall actually occurred. A two parameter gamma distribution fit the data. GRA

N76-33620# Virginia Polytechnic Inst. and State Univ., Blacksburg. Virginia Water Resources Research Center.
VERTICAL ELECTRICAL RESISTIVITY SOUNDINGS TO LOCATE GROUND WATER RESOURCES: A FEASIBILITY STUDY
Mohamed A. Sabet (Old Dominion Univ.) Nov. 1975 67 p refs
(PB-251393/5; VPI-VWRRC-Bull-73; W76-05835) Avail: NTIS HC $4.50 CSCL 08H

The occurrence of ground water in the coastal plain region of southeastern Virginia and northeastern North Carolina, as indicated by the results of 45 vertical resistivity soundings (VES) is discussed. Soundings were taken with Schlumberger array with a maximum separation of 8,000 feet between the current electrodes. The VES data were interpreted through an automatic computer interpretation program, and by the curve-matching method. GRA

N76-33621# Wyoming Univ., Laramie. Water Resources Research Inst.
HYDROLOGY OF THE MADISON FORMATION AND ITS POTENTIAL USE FOR WATER SUPPLY FOR ENERGY DEVELOPMENT
Peter W. Huntoon Apr. 1976 44 p refs
(Contracts DI-14-31-0001-4051; DI-14-31-0001-5051; DI-14-31-0001-6053)
(PB-254543/2; W76-09757; OWRT-A-019-WYO(2)) Avail: NTIS HC $4.00 CSCL 08H

The amount and sources of precipitation on the Bighorn Mountains in Wyoming was studied. It is shown that approximately 400,000 ac ft/yr of recharge water is provided to the Madison aquifer in the Powder River Basin. Recharge takes place through outcrops primarily along fractures such as joints, partings along bedding, and secondary fractures associated with faults and folds. The fractures along faults and folds produce zones of large secondary permeability that parallel the trends of the structures. These zones are important in the recharge process only where they trend from the flanks of the Bighorn range into the Powder River Basin. The average annual recharge to the Madison aquifer along the 145 mi of outcrop examined in Wyoming is 2,800 ac ft/mi. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N76-33622*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INITIAL OPERATION OF A SOLAR HEATING AND COOLING SYSTEM IN A FULL-SCALE SOLAR BUILDING TEST FACILITY
Richard H. Knoll, David Miao, Irvin L. Hamlet, and Ronald N. Jensen 1976 18 p refs Presented at Intern. Solar Energy Soc. Conf., Winnipeg, Canada, 15-20 Aug. 1976
(NASA-TM-X-73519; E-8931) Avail: NTIS HC $3.50 CSCL 10A

The Solar Building Test Facility (SBTF) was constructed to advance the technology for heating and cooling of office buildings with solar energy. Its purposes are to (1) test system components which include high-performing collectors, (2) test the performance of a complete solar heating and cooling system, (3) investigate component interactions, and (4) investigate durability, maintenance and reliability of components. The SBTF consists of a 50,000 square foot office building modified to accept solar heated water for operation of an absorption air conditioner and for the baseboard heating system. A 12,666 square foot solar collector field with a 30,000 gallon storage tank provides the solar heated water. A description of the system and the collectors selected is printed along with the objectives, test approach, expected system performance, and some preliminary results. Author

N76-33623*# Alabama Univ., Huntsville. Center for Environmental and Energy Studies.
SOLAR HEATING AND COOLING TECHNICAL DATA AND SYSTEMS ANALYSIS Interim Status Report, Sep. 1975 - Aug. 1976
D. L. Christensen Sep. 1976 38 p
(Contract NAS8-31298)
(NASA-CR-150012) Avail: NTIS HC $4.00 CSCL 10A

The accomplishments of a project to study solar heating and air conditioning are outlined. Presentation materials (data packages, slides, charts, and visual aids) were developed. Bibliographies and source materials on materials and coatings, solar water heaters, systems analysis computer models, solar collectors and solar projects were developed. Detailed MIRADS computer formats for primary data parameters were developed and updated. The following data were included: climatic, architectural, topography, heating and cooling equipment, thermal loads, and economics. Data sources in each of these areas were identified as well as solar radiation data stations and instruments. D.M.L.

N76-33624*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLAR CELL SURFACE TREATMENT Patent Application
H. W. Brandhorst, Jr. and Cosmo R. Barona, inventors (to NASA) Filed 29 Sep. 1976 12 p
(NASA-Case-LEW-11330-2; US-Patent-Appl-SN-727725) Avail: NTIS HC $3.50 CSCL 10A

A method is proposed for improving the antireflective properties of solar cells. Grooves are formed by etching the surface of the cell to form two walls each having an angle of 125.3 degrees with the surface of the solar cell. The walls forming the groove intersect at a V-shaped angle of about 70.6 degrees at a depth of about 0.7 times the width of the groove. Solar cells with such surface modifications reduce the amount

of light reflected from the surface of the solar cell, enhance absorption, and increase the operating efficiency of the cell irrespective of the wavelength of photon energy contacting the surface of the cell. NASA

N76-33625*# Kanner (Leo) Associates, Redwood City, Calif.
ENERGY REQUIREMENT FOR ELECTRIC ROAD VEHICLE PROPULSION
U. Hahn Washington NASA Sep. 1976 11 p refs Transl. into ENGLISH from Bosch Tech. Ber. (Stuttgart), v. 2, no. 5, Nov. 1968 p 207-210
(Contract NASw-2790)
(NASA-TT-F-17226) Avail: NTIS HC $3.50 CSCL 10B

The energy balance is established on the basis of a flow diagram for the energy in an electrically-propelled road vehicle. In addition to energy restoration, the accelerated masses, the efficiencies of the energy source and the transmission means and the possible secondary points of energy consumption are taken into account. The quantitative energy requirements are given. It is shown that the requirements of a simple vehicle for town traffic can be met within the present state of technical development. Author

N76-33626*# Scientific Translation Service, Santa Barbara, Calif.
DEVELOPMENT OF BATTERIES FOR ELECTRICALLY-DRIVEN VEHICLES
Hermann Dietz Washington NASA Sep. 1976 27 p refs Transl. into ENGLISH from Bosch Tech. Ber (West Ger.), v. 2, no. 5, Nov. 1968 p 211-219
(Contract NASw-2791)
(NASA-TT-F-17227) Avail: NTIS HC $4.00 CSCL 10C

The limitations of commercial battery systems for vehicles are discussed and the structure, problems and possibility of suggested new battery systems are described. Author

N76-33627*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LSSA (LOW-COST SILICON SOLAR ARRAY) PROJECT Annual Report, Jan. 1975 - Mar. 1976
9 Aug. 1976 131 p Sponsored in part by ERDA
(Contract NAS7-100)
(NASA-CR-149092; JPL-5101-3; ERDA/JPL-1012-76/5; AR-1) Avail: NTIS HC $6.00 CSCL 10A

The Photovoltaic Conversion Program was established to find methods of economically generating enough electrical power to meet future requirements. Activities and progress in the following areas are discussed: silicon-refinement processes; silicon-sheet-growth techniques; encapsulants; manufacturing of off-the-shelf solar arrays; and procurement of semistandardized solar arrays. Author

N76-33628*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TOWER AND ROTOR BLADE VIBRATION TEST RESULTS FOR A 100-KILOWATT WIND TURBINE
Bradford S. Linscott, William R. Shapton (Cincinnati Univ., Ohio), and David Brown (Cincinnati Univ., Ohio) Washington Oct. 1976 40 p refs
(NASA-TM-X-3426; E-8751) Avail: NTIS HC $4.00 CSCL 10A

The predominant natural frequencies and mode shapes for the tower and the rotor blades of the ERDA-NASA 100-kW wind turbine were determined. The tests on the tower and the blades were conducted both before and after the rotor blades and the rotating machinery were installed on top of the tower. The tower and each blade were instrumented with an accelerometer and impacted by an instrumented mass. The tower and blade structure was analyzed by means of NASTRAN, and computed values agree with the test data. Author

N76-33629# Midwest Research Inst., Kansas City, Mo.
PROGRAM FOR REGIONAL ENERGY ANALYSIS, VOLUME 1 Final Report
W. R. Benson Dec. 1975 141 p refs
(Contract AT(49-1)-3755; MRI Proj. 4046-E)
(ERDA-107-Vol-1) Avail: NTIS HC $5.45

A program of action was designed for the participation of local, state, or regional organizations with crucial roles in energy policy and energy research and development. The regional energy analysis program provides a uniform procedure for analysis of the regional impacts and the consequences of policy decisions relative to research and development leading to new energy sources. It is also applicable to the analysis of the impacts of significant expansion of existing supply sources. Tasks that formed the basis for the program design were: definition of regions, identification of data sources, inventory of models, public participation strategy, and development of candidate programs. As the regional energy analysis program evolved, elements of the program were selectively tested or validated using data from a new energy production technology. An oil shale plant and a solar thermal electric power plant were used in the tests because of the availability of data. ERA

N76-33630# Midwest Research Inst., Kansas City, Mo.
PROGRAM FOR REGIONAL ENERGY ANALYSIS: APPENDICES TO THE FINAL REPORT, VOLUME 2
Nov. 1975 293 p refs
(Contract AT(49-1)-3755; MRI Proj. 4046-E)
(ERDA-107-Vol-2) Avail: NTIS HC $7.60
For abstract, see N76-33629.

N76-33631# Sandia Labs., Albuquerque, N.Mex.
SANDIA LABORATORIES ENERGY SYSTEM SIMULATION COMPUTER PROGRAM
M. W. Edenburn 1975 23 p refs Presented at the Ann. Meeting of the Intern. Solar Energy Soc., Los Angeles, Calif. 28 Jul. 1975 Sponsored by ERDA
(CONF-750712-8) Avail: NTIS HC $4.50

A computer program (SOLSYS) was developed to simulate the transient performance of solar energy systems. The program consists of a component subroutine library, an information subroutine library, a control component subroutine library and an executive program. Component subroutines model the performance of fluid handling components which can be connected to construct nearly any desired energy system. Information subroutines supply time-dependent information such as insolation data, weather data, heating requirements, air-conditioning requirements, hot water requirements, and electrical requirements. Control component subroutines model components which control temperatures in the system and switch fluid flow between fluid channels. The executive program handles input and output and calls on subroutines in the appropriate order. The program was used to predict the performance of Sandia's solar energy test bed when applied to a Sandia Laboratories building and to a small neighborhood of single family homes. Collector, power generation, and storage requirements were determined and the details of system performance were predicted. Author (ERA)

N76-33632# Brookhaven National Lab., Upton, N.Y.
NIGHTTIME USE OF FLAT PLATE TYPE SOLAR ENERGY COLLECTORS AS A HEAT SINK IN SOLAR ASSISTED HEAT PUMP SYSTEMS, A PRELIMINARY ANALYSIS
J. G. Cottingham and W. G. Wilhelm 9 Sep. 1975 12 p refs Sponsored by ERDA
(BNL-20479) Avail: NTIS HC $4.50

In the cooling mode, 'solar assisted heat pump' systems pump heat from the building to a heat sink, usually an evaporative cooler. This component can be eliminated, if the flat plate solar energy collector, not otherwise used in this mode, could be used as a nighttime heat sink. This possibility is analyzed and found feasible for the climatic conditions found on Long Island, New York. Author (ERA)

N76-33633# California Univ., Livermore. Lawrence Livermore Lab.
PRESENT STATUS AND FUTURE PROSPECTS FOR NONELECTRICAL USES OF GEOTHERMAL RESOURCES
J. H. Howard, ed. 3 Oct. 1975 168 p refs
(Contract W-7405-eng-48)
(UCRL-51926) Avail: NTIS HC $7.60

Current and potential uses of geothermal resources, including residential and commercial, agricultural and industrial applications, are described. Also discussed are exploration and drilling; extraction and distribution; environmental impact; and economic and regulatory problems. Applications in a number of countries are described. Among the report's conclusions are: (1) Geothermal resources are widely distributed throughout the world. (2) The

extraction of these resources presents no serious technical problems. (3) A wide variety of economically viable applications for these resources currently exists. (4) Current nonelectrical applications have a favorable economic structure compared with those of other energy sources. (5) Disposal of spent fluids has a significant ecological impact. Reinjection appears to be the most likely alternative. (6) The legal and institutional framework surrounding these applications needs both clarification and simplification. ERA

N76-33634# California Univ., Berkeley.
OPTIMIZATION OF THERMODYNAMIC EFFICIENCY IN BINARY-TYPE GEOTHERMAL ELECTRIC POWER GENERATING PLANTS
E. Eno Sep. 1975 24 p refs
(Contract W-7405-eng-48)
(LBL-4404) Avail: NTIS

Calculations and curves are presented which prove that for each turbine entry temperature, there is an entry pressure which will optimize the thermodynamic efficiency of a binary type geothermal power plant. Comparisons are made between thermodynamic efficiency and another method of rating process efficiency. ERA

N76-33635# California Univ., Livermore. Lawrence Livermore Lab.
WIND POWER STUDIES: INITIAL DATA AND NUMERICAL CALCULATIONS Progress Report, Sep. - Dec. 1975
D. M. Hardy 15 Oct. 1975 44 p refs
(Contract W-7405-eng-48)
(UCRL-50034-76-1) Avail: NTIS HC $4.00

Initial data collection and numerical modeling results in wind energy research conducted by the Lawrence Livermore Laboratory are reported. The use of conventional and laser anemometry is described. Also discussed is the development of a data collection and data processing capability appropriate for a major numerical study of wind energy as well as a three-dimensional numerical model of wind fields over complex terrain. Illustrative numerical calculations of nondivergent vector wind fields are presented. Author (ERA)

N76-33636# Idaho National Engineering Lab., Idaho Falls.
GEOTHERMAL STEAM PLANT MODELING AND POWER TRADEOFF STUDIES
C. J. Shaffer Jan. 1976 60 p refs
(Contract E(10-1)-1375)
(ANCR-1295) Avail: NTIS HC $5.50

A computer model of an open loop flashed steam plant for producing electrical power from a hot geothermal water supply is documented. The model has the capability of tracing the dissolved gases, N2 and CO2, throughout the plant. Sensitivity studies were performed on several of the geothermal source, design, and atmospheric parameters using the source conditions found in the Raft River Valley as a base case. ERA

N76-33637# Allied Chemical Corp., Buffalo, N.Y. Specialty Chemical Div.
PREVENTION OF BIOFOULING ON HEAT TRANSFER SURFACES OF OCEAN THERMAL ENERGY CONVERTERS Progress Report, 1 May - 30 Nov. 1975
R. L. Ostrozynski and P. E. Jones Dec. 1975 110 p refs
(Contract E(11-1)-2692)
(COO-2692-1) Avail: NTIS HC $5.50

Chemical processes utilizing a combination of certain fluorochemicals and tribulyltin based toxicants for treating the surfaces of metals which may be used to fabricate Ocean Thermal energy Conversion heat exchangers were developed. The effectiveness of these surface treatments as antibiofoulants was also investigated. Aluminum alloy No. 3003-H14 and titanium were tested, neither of which proved satisfactory. ERA

N76-33638# Battelle Pacific Northwest Labs., Richland, Wash.
COMPARISON OF SOLAR POND CONCEPTS FOR ELECTRICAL POWER GENERATION
K. Drumheller, J. B. Duffy, O. K. Harling, C. A. Knutsen, M. A. McKinnon, P. L. Peterson, L. H. Shaffer, D. L. Styris, and R. Zaworski Oct. 1975 128 p refs
(Contract E(45-1)-1830)
(BNWL-1951) Avail: NTIS HC $5.45

Various solar pond concepts for electric power generation were identified, including but not limited to: (1) nonconvective salt gradient solar pond; (2) ponds with various plastic or other membranes at suitable locations to minimize or eliminate convection; (3) ponds which are totally or partially gelled to reduce or eliminate convection; and (4) shallow convecting ponds. The performance of these various concepts was analyzed and compared. The pond cost and overall power plant system cost for each concept assuming the nonconvective gradient salt pond as the base case were estimated. The approach included a preliminary design of several power plant systems based on solar pond concepts, and performance and economic evaluation based on these preliminary designs. ERA

N76-33639# Brookhaven National Lab., Upton, N.Y.
MOTOR VEHICLE STORAGE OF HYDROGEN USING METAL HYDRIDES Final Report
Oct. 1974 92 p refs Sponsored by ERDA and EPA
(TEC-75/001) Avail: NTIS HC $5.45

Results are reported of an experimental and analytical study of the storage of hydrogen in motor vehicles using metal hydrides. The central purpose of the study was the identification, synthesis, and evaluation of hydrides having a potential for use in automobiles on a basis comparable to present gasoline fueled vehicles. Efforts of the studies included: (1) a review and rating of known and potential hydrides; (2) the preparation of a reference design; (3) an experimental search for new hydrides; and (4) the determination of engineering properties of candidate hydrides. The experimental search for hydrides was given priority over the reference design work. Several materials were identified by the initial review as having a potential worth investigating experimentally. These were magnesium and magnesium-aluminum alloys. A number of these materials did respond to relatively simple hydriding procedures. The primary output of the reference design work was a mathematical model of the behavior of two hydride storage bed concepts. Author (ERA)

N76-33640# California Univ., Berkeley. Lawrence Berkeley Lab.
NITINOL ENGINE PROJECT TEST BED Final Report, 1 Jun. 1974 - 31 Jul. 1975
R. Banks, P. Hernandez, and D. Norgren 31 Jul. 1975 57 p refs Sponsored in part by ERDA and NSF
(UCID-3739; NSF/RANN/SE/AG-550/FR-75-2) Avail: NTIS HC $4.50

A test bed engine was designed with the intent of reaching a 1 kilowatt size demonstration unit when operating as an engine. It can also be operated as a test bed driven by an electric motor for testing Nitinol elements. It was completed in December, 1974 and has since been operated in the test bed mode. Tests were run using 8 wire 0.5 mm diameter 55-nitinol elements cycled in tension; work per cycle was indicated on stress strain oscillograms. Indicated power per kg measurements exceeded the long range economic design objective. However, the very high power densities were accompanied by low endurance. The results of parametric studies and changes in nitinol cyclic behavior are presented. Author (ERA)

N76-33641# Energy Research and Development Administration, Washington, D.C.
ENERGY TRANSFER AND ENERGY STORAGE
W. Heinz 1974 21 p refs Transl. into ENGLISH from German Report VDI-208
(ERDA-TR-83; VDI-208) Avail: NTIS HC $3.50

The increasing consumption of electrical energy together with the growing proportion of nuclear energy as a primary energy source require new concepts both with respect to energy transfer as well as energy storage. Research on the use of low temperature technology is reported. Other advanced transfer and storage systems are compared. Author (ERA)

N76-33642# Exxon Research and Engineering Co., Linden, N.J. Government Research Lab.
STUDY OF AUTOMOTIVE STORAGE OF HYDROGEN USING RECYCLABLE LIQUID CHEMICAL CARRIERS
O. Sultan and H. Shaw Jun. 1975 102 p refs Sponsored in part by ERDA

(Contract EPA-68-02-2135)
(TEC-75/003) Avail: NTIS HC $5.45

The catalytic dehydrogenation of naphthenes to their corresponding aromatic compounds was evaluated as a specific noncryogenic approach for the on-board recovery of hydrogen for use as an automotive fuel. The dehydrogenation of methylcyclohexane (MCH) to toluene was used in this study as representative of the contemplated storage system. Although not evaluated in detail, it was assumed that by-product toluene would be recycled to a central hydrogenation facility to regenerate the MCH. Thus, in principle, MCH would not be consumed, but would act as a hydrogen storage medium. It was concluded, based on literature information, thermodynamic and kinetic analyses, engineering considerations, and cost estimates that this method of hydrogen storage does not compare favorably with gasoline fueled automobiles. Approximately 16 times more volume of MCH than gasoline would be needed for the same mileage range, thus severely curtailing the range of an automobile with a reasonably sized MCH tank. In addition, an unreasonable amount of time (in excess of 20 minutes) would be needed to bring the dehydrogenation catalyst to operating temperature (589 K) from a cold start. Author (ERA)

N76-33643# International Harvester Co., San Diego, Calif. Solar Div.
AUTOMOTIVE STORAGE OF HYDROGEN USING MODIFIED MAGNESIUM HYDRIDES Final Report, 1 Jul. 1974 - 31 Jan. 1975
D. A. Rohy, J. F. Nachman, and T. E. Duffy Jul. 1975 56 p refs Sponsored in part by ERDA
(Contract EPA-68-03-2041)
(TEC-75/002) Avail: NTIS HC $5.45

Metal hydrides store more hydrogen per unit volume than normal high pressure or cryogenic techniques. Because of its low weight and high hydrogen storage densities, modified magnesium hydride offers the greatest potential for automotive storage of hydrogen. Recent experimental and analytic work was directed toward the optimization of this storage system. Due to the relative stability of MgH2, modifications of the form MgMH/sub x/ (M = metal ion) were made to decrease the dissociation temperature while retaining high hydrogen capacity. System studies indicate that hydride dissociation temperature should be approximately 200 C to assure uninterrupted fuel flow at all driving and idle conditions. Experimental data developed in this study show that zinc modified Mg-Ni alloys offer the greatest potential of reaching that goal. ERA

N76-33644# Little (Arthur D.), Inc., Cambridge, Mass.
BENEFITS/COSTS OF ADVANCED POWER CYCLE RESEARCH: A MID-1974 ANALYSIS Final Report
Dec. 1975 83 p refs
(Contract E(49-18)-1756)
(FE-1756-1) Avail: NTIS HC $5.00

Two advanced power cycle technologies were selected for analysis as proxies for the many technologies within the advanced power cycle family: combined cycles (specifically, an integrated gasifier combined cycle system), and magnetohydrodynamics (MHD). The benefits quantified are limited to those defined as savings to be realized as a result of having cheaper energy available through advanced power cycles systems. At a discount rate of 6%, the apparent benefit/cost ratios related to combined cycles and MHD were 31 and 16, respectively. Author (ERA)

N76-33645# Little (Arthur D.), Inc., Cambridge, Mass.
GOALS STUDY FOR TECHNICAL DEVELOPMENT AND ECONOMIC EVALUATION OF THE COMPOUND PARABOLIC CONCENTRATOR CONCEPT FOR SOLAR ENERGY COLLECTOR APPLICATIONS
18 Jul. 1975 62 p refs
(Contract W-31-109-eng-38)
(ANL-K-75-3190-1) Avail: NTIS HC $5.50

The Argonne National Laboratories performed a 6 week goal study for the purpose of evaluating the technical applicability and the economic viability of the compound parabolic concentrator (CPC) concept for all solar energy applications except large central power plants. During this period, the use of CPC units in a large number of residential, industrial, and commercial applications was studied. The predicted performance of CPC augmented solar collectors was compared with other available solar collectors. Application of the CPC to on-site power generation using solar Rankine power generation techniques was studied in detail. Techniques and costs for fabricating CPC collectors were studied. Collectors with insulation and with full-surface reflectors were studied along with the use of CPC augmentation for evacuated receivers with selective surfaces. Manufacturing costs are compared with those reported by others. Author (ERA)

N76-33646# Los Alamos Scientific Lab., N.Mex.
FORCED OSCILLATIONS OF THE LOS ALAMOS SCIENTIFIC LABORATORY'S DRY HOT ROCK GEOTHERMAL RESERVOIR
Y. C. Hsu Nov. 1975 5 p refs
(Contract W-7405-eng-36)
(LA-6170-MS) Avail: NTIS HC $4.50

Equations of motion are derived for the Los Alamos Scientific Laboratory's geothermal reservoir consisting of an elastic half-space (rock), with an open vertical pipe from the surface connected at depth with a vertical penny-shaped fracture. This reservoir, which is filled with water (laminar flow through a pipe), is subjected to seismic waves and/or blast-like impulses applied downhole. Oscillations (responses) of the water column, of the downhole internal net pressure required to keep the fracture open, and of the fracture itself, are found for the reservoir. If the fracture is continuously oscillated subject to pressure waves applied downhole and failure of the fracture surface occurs, it is usually through fatigue after a long period of time. Of concern next is transient oscillation of the fracture when downhole blast-like impulses are applied. ERA

N76-33647# Northwestern Univ., Evanston, Ill.
BASIC RESEARCH ON CERAMIC MATERIALS FOR ENERGY STORAGE AND CONVERSION SYSTEMS Progress Report, 1 Apr. - 30 Nov. 1975
D. H. Whitmore Dec. 1975 7 p
(Contract E(11-1)-2564)
(COO-2564-1) Avail: NTIS HC $3.50

Probes were used for movement of ionic and electronic charge carriers in ceramic materials suitable for solid electrolyte and electrode applications in high performance, secondary battery, and fuel cell systems. Special emphasis is placed on developing a better understanding of the effects of structure, impurities, and composition on transport mechanisms and on developing detailed knowledge of the kinetics and mechanisms of reactions occurring (on a microscopic scale) at the electrode-electrolyte interfaces of energy storage and conversion systems.
Author (ERA)

N76-33648# Sandia Labs., Albuquerque, N.Mex.
ANALYSIS OF A SOLAR TOTAL ENERGY SYSTEM
B. W. Marshall 1975 28 p refs Sponsored by ERDA
(TID-26914) Avail: NTIS HC $5.00

A solar system to provide the electrical, thermal, and hot water requirements of a hypothetical 1000-home community was analyzed. The community is located in Albuquerque, New Mexico, and real 1962 solar and weather data were used. The system is composed of parabolic cylindrical collectors, high and low temperature storage systems, a turbogenerator, cooling towers, auxiliary fossil fuel furnaces, a thermal distribution system, and necessary pumps and controls. The system performance for four collector areas was evaluated and the fossil fuel savings ranged from 36 to 79 percent. Using the criteria of overnight storage combined with minimum waste of solar energy, a system with a total collector area of 24390 sq. m. was found to be near optimum. Economic analyses suggest that over the next 30 years energy from the solar system would be less than 1.5 times more expensive than energy supplied to the home by conventional electric and natural gas means and this factor can be reduced by solar economic incentives and higher than predicted fossil fuel prices. Author (ERA)

N76-33649# Bonner and Moore Associates, Inc., Houston, Tex.
IMPACT OF AUTOMOTIVE FUEL CHANGES ON THE US REFINING INDUSTRY. AN ECONOMIC/TECHNOLOGICAL ASSESSMENT Final Report
F. P. Frederick, J. F. Moore, J. S. Bonner, J. C. Dickson, and L. P. Karvelas 15 Nov. 1975 313 p

(Contract E(49-18)-2216; ERDA-76-40)
(FE-2216-1) Avail: NTIS HC $7.60

The investigation was conducted by imposing various fuel demand forecasts (1975 through 2000) upon a mathematical model of the U.S. refining industry. Study results indicate that: (1) existing refining technology will now allow the U.S. refining industry to meet the demand imposed by introduction of an all-diesel auto fleet; (2) demands for 'broadcut' fuel could be met, but the varying characteristics for this fuel would create fuel marketing and auto fuel system problems; and (3) all of the fuel demand patterns studied have measurable and important economic impacts on the refining industry; these impacts, however, are overshadowed by the effect which varying automotive fuel requirements have on the U.S. demand for crude oil. Full study results and information on method are detailed. Additionally, a special study under slightly different fuel demand patterns is reported in Addendum 1 to the report. ERA

N76-33650# Atomic Energy of Canada Ltd., Pinawa (Manitoba).
ASSESSMENT OF THE UTILIZATION OF WASTE HEAT IN GREENHOUSES
S. L. Iverson, D. R. Prowse, and J. D. Campbell Jan. 1976 111 p refs
(AECL-5109) Avail: ERDA Depository Libraries HC $5.50

The economic feasibility of utilizing waste heat from the moderator circuit of the CANDU G-2 reactor to heat greenhouses was examined. Waste heat recovery systems were compared to a conventional gas-fired em. Each waste heat recovery system involved the recirculation of warm light water from modified moderator heat exchangers through a distribution system to finned-tube heat exchangers in the greenhouses. The distribution system was assumed to service an 8 or 10 hectare (20-25 acre) greenhouse vegetable industry located immediately outside the 914 m reactor exclusion zone. The lowest calculated heating and ventilation costs for waste heat systems were $9.55 per year per square meter of growing surface for the climate of Winnipeg, Manitoba. A conventional greenhouse heated by natural gas would experience the same annual heating costs. Potential improvements to the waste heat utilization system were discussed, each of which would make the system economically competitive at current natural gas prices. Author (ERA)

N76-33651# California Univ., Berkeley.
TOWARDS MORE PRODUCTIVE ENERGY UTILIZATION
L. Schipper 1 Oct. 1975 82 p refs Presented at the Ann. Meeting of Am. Assoc. for the Advan. of Sci., Boston, 24 Feb. 1976
(Contract W-7405-eng-48)
(LBL-3299; Conf-760217-2) Avail: NTIS HC $5.00

The nature of energy use and strategies which increase the efficiency of energy use are discussed. Measures of physical and economic efficiency are discussed. It is suggested that specific energy requirements of tasks in the United States could be reduced by 33 to 40 percent over the next few decades at cost savings to energy users. Most of the energy conservation strategies required would have only a slight effect on life style, as well. In addition to saving energy and money, higher energy use efficiency raises the total demand for labor in the economy, lowers pollution, reduces the total capital requirements of future energy activities, and allows society to proceed cautiously with risky or marginal energy sources. Many barriers to more efficient energy utilization exist, barriers whose solutions are socio-economic or political rather than technical. These barriers are reviewed, and some suggestions are made which would allow society to overcome them in seeking to use energy more efficiently than today. ERA

N76-33652# Los Alamos Scientific Lab., N.Mex.
ZUNI MOUNTAINS, NEW MEXICO AS A POTENTIAL DRY HOT ROCK GEOTHERMAL ENERGY SITE
A. W. Laughlin and F. G. West Dec. 1975 13 p refs
(Contract W-7405-eng-36)
(LA-6197-MS) Avail: NTIS HC $4.50

Many of the criteria for the successful exploitation of energy from dry hot rock are met in the Zuni Mountains, New Mexico. This area falls within a broad region of abnormally high heat flow on the Colorado Plateau. Within this region, a variety of evidence indicates that local hot spots may be present. These hot spots are prime targets for dry hot rock exploration. A site-evaluation program utilizing geological, geochemical-geochronological, and geophysical techniques is proposed to delineate the optimal sites for subsequent exploratory drilling. ERA

N76-33653# Sandia Labs., Albuquerque, N.Mex.
TRACKING ANGLES AND RATES FOR SINGLE DEGREE OF FREEDOM SOLAR COLLECTORS
A. F. Veneruso Mar. 1976 25 p refs
(Contract AT(29-1)-789)
(SAND-76-0027) Avail: NTIS HC $3.50

The motion required by tracking systems for single degree of freedom solar collectors such as those used in the Sandia Laboratories' Total Energy System is described. Specific consideration is given to east-west and north-south oriented collectors consisting of parabolic trough reflectors. Graphs and equations of motion are given to provide inputs for identifying tracker system requirements independent of the specific type of tracker hardware used. ERA

N76-33654# Sandia Labs., Albuquerque, N.Mex.
MAGMA ENERGY RESEARCH PROJECT Project Summary, 1 Jul. 1974 - 30 Jun. 1975
J. L. Colp, M. J. Davis, E. J. Graeber, and H. C. Hardee Mar. 1976 38 p refs
(Contract AT(29-1)-789)
(SAND-75-0451) Avail: NTIS HC $4.00

The feasibility of extracting energy directly from deeply buried circulating magma sources is discussed. Project plans describe a concept whereby a fully closed heat exchanger system is inserted directly into such a magma source to allow the heat energy to be brought to the surface with minimal environmental impact. A summary of previous efforts is given. The achievements and future plans for source location and definition, source tapping, magma characterization, magma materials compatibilities studies, and energy extraction studies are outlined. ERA

N76-33655# California Univ., Livermore. Lawrence Livermore Lab.
ESTIMATE OF THE GEOTHERMAL ENERGY RESOURCE IN THE SALTON TROUGH, CALIFORNIA
D. Towse 12 Feb. 1976 25 p refs
(Contract W-7405-eng-48)
(UCRL-51851-Rev-1) Avail: NTIS HC $3.50

The geothermal energy resource in the Salton Trough was estimated based on measured geologic parameters, extrapolation of data from geophysical surveys, and research in energy conversion systems. The total resource is estimated at 2 x 10 to the 19th power J contained in 15 x 10 to the 12th power kg of water, the quality of which varies from fresh to over 25 percent dissolved solids. More than one-half of the resource is in the high saline deposit at the Salton Sea. It is estimated that 8 x 10 to the 8th power MWh of electric energy, equivalent to 5,000 MW for 20 yr, could be generated. This is a substantial part of the present electric power requirements of Southern California and is the energy equivalent of 1.3 billion barrels of oil. ERA

N76-33656# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
SOLAR PHOTOVOLTAIC PANELS AND MODULES [PANNELLI E MODULI SOLARI FOTOVOLTAICI]
G. V. Pallottino Apr. 1975 17 p refs In ITALIAN
(LPS-75-14) Avail: NTIS HC $3.50

The characteristics of solar panels to be used in terrestrial applications are presented together with an inventory of solar photovoltaic cells manufactured by various firms. ESA

N76-33657# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
SOLAR ENERGY PRELIMINARY STUDY: A SELF-SUPPLIED MEASUREMENT STATION [STUDIO PRELIMINARE SULL ENERGIA SOLARE: UNA STAZIONE DI MISURA AUTOALIMENTATA]
G. Balestrino, A. Egidi, and G. V. Pallottino Dec. 1975 38 p refs In ITALIAN
(LPS-75-36) Avail: NTIS HC $4.00

Prospects and perspectives of photovoltaic cells as solar generators are reviewed. An electronic device was designed and constructed in order to measure and record time performance of two silicon photovoltaic cell panels and to compare the performance of solar generators vs standard pyrometers. The operational characteristics of the measuring system, the signal processing, and the recording systems are described together with the principles of measuring the power, the short circuit current, and other parameters inherent in the performance of photovoltaic cells. ESA

N76-33658# AAI Corp., Baltimore, Md.
PRODUCTION OF METHANE USING OFFSHORE WIND ENERGY, EXECUTIVE SUMMARY
R. B. Young, A. F. Tiedemann, Jr., L. G. Marianowski (Inst. of Gas Technol., Chicago), and E. H. Camara (Inst. of Gas Technol., Chicago) Nov. 1975 35 p
(Contract NSF C-993)
(PB-252308/2; AAI-ER-8447; NSF/RA/N-75-295A) Avail: NTIS HC $4.00 CSCL 07A

The potential of the electrical generation by wind energy of hydrogen, converting it to methane, and introducing it into natural gas pipelines was assessed. The electrochemical process was defined along with the theoretical feasibility and the estimated cost of producing methane gas from wind energy using calcium carbonate from underwater sands. The site locations used were Nantucket Shoals off the coast of Massachusetts and Cape Hatteras shoal water areas. GRA

N76-33659# AAI Corp., Baltimore, Md.
PRODUCTION OF METHANE USING OFFSHORE WIND ENERGY
R. B. Young, A. F. Tiedemann, Jr., L. G. Marianowski (Inst. of Gas Technol., Chicago), and E. H. Camara (Inst. of Gas Technol., Chicago) Nov. 1975 79 p refs
(Contract NSF C-993)
(PB-252307/4; AAI-ER-8447-F; NSF/RA/N-75-295) Avail: NTIS HC $5.00 CSCL 07A

The feasibility of converting wind energy to methane gas was investigated. The basic approach consists of using offshore winds to drive generators which supply electricity to electrolysis cells. Electrolysis of distilled sea water produces hydrogen. Carbon dioxide is derived from underwater carbonate deposits. These gases are combined to form methane. The methane gas produced by the process can be used in existing natural gas-burning equipment, thus conserving a valuable capital investment. GRA

N76-33660# Federal Energy Administration, Washington, D.C. Nuclear Energy Analysis Div.
SOLAR COLLECTOR MANUFACTURING ACTIVITY Semi-annual Report, Jul. - Dec. 1975
Howard L. Magnas Mar. 1976 16 p 2 Vol.
(PB-252196/1; FEA/B-76-161) Avail: NTIS HC $3.50 CSCL 13A

Private firms that manufactured and sold solar collectors during the second half of calendar year 1975 were surveyed. Statistics on economic activity in the solar heating and cooling area were obtained and production growth rates were identified. Results of earlier surveys covering calendar year 1974 and the first 6 months of 1975 were used for making baseline comparisons. GRA

N76-33661# Federal Energy Administration, Washington, D.C. Nuclear Energy Analysis Div.
SOLAR COLLECTOR MANUFACTURING ACTIVITY Semi-annual Report, Jan. - Jul. 1975
Howard L. Magnas Dec. 1975 13 p 2 Vol.
(PB-252197/9; FEA/B-75/697) Avail: NTIS HC $3.50 CSCL 13A

The results of a survey of private firms that manufactured and sold solar collectors in the first half of calendar year 1975 are presented. GRA

N76-33662# National Bureau of Standards, Washington, D.C.
SPINELS FOR MHD-ELECTRODES
H. P. R. Frederikse, W. R. Hosler, A. J. Armstrong, and T. Negas 1976 6 p refs Presented at 15th Symp. on Eng. Aspects of Magnetohydrodyn., Pennsylvania Univ., Phila., 24-26 May 1976 Submitted for publication Sponsored in part by ERDA
(PB-253618/3) Avail: NTIS HC $3.50 CSCL 10B

Solid solutions of Mg-chromite and Mg-aluminate spinels and magnetite appear to be promising materials for MHD electrodes. High temperature electrical conductivity data and some structural and chemical properties of these compounds are presented. The Mg-Al-spinels show good resistance to seed corrosion, while the Mg-Cr-spinels appear to stand-up well in a slagging environment. A third spinel, composed of Fe_3O_4 and Co_3O_4, is a very good electrical conductor and has potential as a lead-out material. GRA

N76-33663# National Bureau of Standards, Washington, D.C.
THE MANCHESTER, N. H., EXPERIMENTAL ENERGY OFFICE BUILDING Final Report
Frank J. Powell 1974 15 p Presented at the Seminar on Energy Conservation by Design, Orlando, Fla., 20-21 Mar. 1974
(PB-253400/6) Avail: NTIS HC $3.50 CSCL 13A

This report presents a summary of some of the initial work done by NBS in estimating yearly energy savings by comparing projections of a base building design using normal GSA practice with a new design aimed specifically at conserving energy. Also, a prediction of energy savings in the same manner is given for Orlando Florida, using the same building and operation information changing only the weather data. GRA

N76-33664# Black and Veatch Consulting Engineers, Kansas City, Mo.
SOLAR MATERIALS AND COMPONENTS TEST PROGRAM Final Report
S. L. Levy Apr. 1976 265 p Sponsored by the Elec. Power Res. Inst.
(PB-253480/8; EPRI-550-1) Avail: NTIS HC $9.00 CSCL 10B

The development of an EPRI Solar Materials and Components Test Facility was considered. Also addressed was the broader question of the need for testing services and the alternative means for providing those services. An assessment is given of what testing must be done for successful completion of EPRI's solar energy subprograms. Plan 1, and EPRI's Solar Materials and Components Test Facility in which most of the tests are performed--outside tests being solar thermal receiver performance at the ERDA 5 MW Test Facility, etc.; Plan 2, a reduced operation and equipped EPRI Facility with outside testing under contract to EPRI; Plan 3, purchase of all testing services and data via contracts with EPRI. GRA

N76-33665# National Swedish Inst. for Building Research, Stockholm.
ENERGY CONSERVATION IN BUILDINGS, R AND D
1976 63 p refs
(PB-253429/5; D1:1976; ISBN-91-540-2537-0) Avail: NTIS HC $4.50 CSCL 10A

Research and development projects in Sweden are discussed. Projects relate to energy use in industrial processes, transport, communications, and indoor comfort; retrieval of energy from goods; energy production; and general energy systems analysis. GRA

N76-33666# California Univ., Berkeley. Lawrence Berkeley Lab.
A QUADRATIC PROGRAMMING ANALYSIS OF ENERGY IN THE UNITED STATES ECONOMY Final Report
C. Roger Glassey and Peter Benenson Dec. 1975 83 p refs (Proj. 263-1)
(PB-252209/2; EPRI-ES-116; EPRI-RP-263-1-F) Avail: NTIS HC $5.00 CSCL 21D

A linear programming input-output model of the U.S. economy is described. The elasticity of demand for various commodities is included in the model. The model is greatly simplified by aggregating to 20 economic sectors and by assuming that the final demand for each sector output is a linear function of its own price. An equilibrium state of model economy is calculated by maximizing a quadratic function subject to the same kind of constraints that appear in the linear programming model, i.e., by solving a quadratic program. The input data was varied to simulate four scenarios. GRA

N76-33667# Federal Energy Administration, Washington, D.C. Office of Oil and Gas Analysis.
UNDERGROUND STORAGE OF NATURAL GAS IN THE UNITED STATES
Albert F. Bass and James McCarrick Mar. 1976 17 p refs (PB-250363/9; FEA/B-76/088) Avail: NTIS HC $3.50 CSCL 21D

This report is the first effort to survey underground gas storage on a heating season basis for the entire United States. The survey covered 80 storage operators who reported 375 storage reservoirs in 26 states with a total reservoir capability of 6.364 Bcf. The report contains tables which indicate total amount of gas in storage at the beginning of the 1974 heating season, the amount injected and withdrawn during the following year, and the amount of gas in storage at the beginning of the following heat season; tables listing underground gas storage by operator, November 1, 1974 - November 1, 1975; and a map illustrating the distribution of natural gas storage reservoirs in the United States. GRA

N76-33668# Transportation Systems Center, Cambridge, Mass.
ENERGY STATISTICS: A SUPPLEMENT TO THE SUMMARY OF NATIONAL TRANSPORTATION STATISTICS Final Report
William F. Gay Aug. 1975 155 p
(PB-252612/7; DOT-TSC-OST-75-33) Avail: NTIS HC $6.75 CSCL 10A

Selected time-series data describing the transportation, production, processing, and consumption of energy are presented. Revenues and expenses of oil pipeline companies, number and capacities of U.S. tank ships, the total crude oil transported in the U.S. by method of transportation; growth over time of the U.S. oil and natural gas reserves, refinery capacity and yields; and trends in the demand for fuel and power are discussed. GRA

N76-33669# Oklahoma Univ., Norman. Science and Public Policy Program.
FIRST YEAR WORK PLAN FOR A TECHNOLOGY ASSESSMENT OF WESTERN ENERGY RESOURCE DEVELOPMENT Final Socioeconomic Environmental Studies Series
Irvin L. White, Michael A. Chartock, Leon Leonard, Cary N. Bloyd, Martha W. Gilliland et al Mar. 1976 346 p refs Prepared in cooperation with Radian Corp., Austin, Tex.
(Contract EPA-68-01-1916)
(PB-252034/4; EPA-600/5-76-001) Avail: NTIS HC $10.00 CSCL 10A

The energy resources addressed are coal, oil shale, oil, natural gas, geothermal, and uranium. The geographical focus is on the states of North and South Dakota, Montana, Wyoming, Utah, New Mexico, Arizona and Colorado. The time frame to be addressed is the period 1975-2000. The Assessment is designed to identify and quantify the diverse impacts of energy development in the West, including secondary or higher order impacts. Further, the assessment will identify and assess policy alternatives for dealing with these impacts, with a special focus on environmental protection strategies. Nine scenarios are used to structure the analysis. GRA

N76-33670# Federal Energy Administration, Washington, D.C.
NATIONAL ENERGY OUTLOOK: 1976
Feb. 1976 591 p refs
(PB-252224/1; FEA/N-75/713) Avail: NTIS HC $13.75 CSCL 10A

During the last year (1975), a number of significant international and domestic events occurred which will change The United States' energy future. This report captures these changes and represents the first of an annual series of energy forecasts. The forecasts through 1990 are based on improved versions of the national energy supply and demand models FEA has developed during the last two years, and uses the most up-to-date data which are collected. GRA

N76-33671# Washington State Univ., Pullman.
SOCIETAL IMPLICATIONS OF ENERGY SCARCITY. SOCIAL AND TECHNOLOGICAL PRIORITIES IN STEADY STATE AND CONSTRICTING SYSTEMS
Lewis F. Carter, Louis N. Gray, Theodore Greenstein, Toby Jayaratne, and Gerald Williams Mar. 1976 191 p refs
(PB-252384/3; NSF/ERG-76-3) Avail: NTIS HC $7.50 CSCL 10A

The results of a two day seminar that brought together academics with related research interests, representatives of business and industries which either produce or consume large quantities of energy, and representatives of interested state and regional governments are reported. The seminar participants (1) assessed the utility and appropriateness of several major sociological perspectives for predicting population responses to scarcity; (2) determined areas of social organization most likely to be impacted by continuing (or worsening) conditions of scarcity and likely forms of social reorganization or adjustment; (3) developed a programmatic research statement indicating where critical information is lacking and priorities for research, and (4) began a dialog concerning the common interests of academic social scientists, energy producing industries, and representatives of state and regional agencies likely to be influenced by social changes related to energy shortages. GRA

N76-33672# Texas Instruments, Inc., Dallas.
SOLAR SILICON DEFINITION Final Report, 15 Oct. 1974 - 15 Sep. 1975
Gene F. Wakefield, Ting L. Chu, George A. Brown, and Victor Harrap Sep. 1975 56 p refs
(Grant NSF AER-75-03972)
(PB-252382/7; TI-03-75-48; NSF/RA/N-75-271) Avail: NTIS HC $4.50 CSCL 10B

Optimum silicon quality for cost effective solar cells suitable for large scale terrestrial utilization was determined. The effects of selected impurities upon the solar cell performance were investigated by preparation and characterization of a matrix of silicon samples. Evaluation of the I-V curves to obtain the slope of the forward current of simple p-n junctions provided rapid materials evaluation. Experimental techniques were demonstrated for achieving reliable data from diodes and solar cells. The primary electrical parameters measured were I-V characteristics. GRA

N76-33673# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
OPTICAL COATINGS FOR FLAT PLATE SOLAR COLLECTORS Final Report, 16 Sep. 1974 - 16 Sep. 1975
H. Y. B. Mar, J. H. Lin, P. B. Zimmer, R. E. Peterson, and J. S. Gross Sep. 1975 156 p refs
(Contract NSF C-957; Grant NSF AER-74-09104)
(PB-252383/5; F0331-FR; NSF/RA/N-75-237) Avail: NTIS HC $6.75 CSCL 10B

Optical coatings that would enhance the economic feasibility of flat plate solar collectors were investigated. Processes were developed for producing single and double layer antireflection coatings on glass by dipping in a silica saturated fluosilicic acid solution. The three most promising selective absorbing plated coatings and their typical optical properties were: black nickel (nickel-zinc sulfide), alpha = 0.95, epsilon = 0.07; black chrome (chrome oxide), epsilon = 0.10. Selective paint coatings were developed with nominal optical properties of alpha = 0.90 and epsilon = 0.30. Materials cost for a typical selective paint were estimated at 0.1 cents/sq ft, a factor of at least 10 lower than the selective plated coatings investigated. Paint coating thickness and pigment alpha were the key parameters affecting optical performance. Improvements in paint coating optical performance can be expected with further development. GRA

N76-33674# Ohio State Univ., Columbus.
SEMICONDUCTOR-ELECTROLYTE PHOTOVOLTAIC ENERGY CONVERTER Quarterly Progress Report, 1 May - 31 Jul. 1975
W. W. Anderson and Larry B. Anderson 15 Aug. 1975 47 p refs
(Grant NSF AER-74-13292)
(PB-252313/2; OSURF-4122-2; NSF/RA/N-75-299) Avail: NTIS HC $4.00 CSCL 10B

The survey of photovoltaic energy conversion at semiconductor-electrolyte interfaces was continued with CdTe and CdSe. The absorption spectrum of these crystals is well matched to the solar spectrum but lower photovoltaic conversion efficiencies were obtained than with the previously reported CdS and GaAs. This appears to be due to uncontrolled electronic

energy states in the forbidden energy bands of these materials. Preliminary results have been obtained on CdS thin film-electrolyte cells. A severe problem of pin hole leakage has been encountered on films prepared to date. The first quantitative measurement of electrode dissolution was carried out on CdS. Analytic instrumentation has been obtained and calibrated so that the authors are now in position to carry out an accurate analytic study of the dissolution process. GRA

N76-33675# Itek Corp., Lexington, Mass. Central Research Labs.
EXPLORATION OF UNCONVENTIONAL SOLAR CELLS, PHASE 1 Quarterly Progress Report, 15 Nov. 1974 - 31 Mar. 1975
Ralph E. Aldrich, Richard R. Addiss, and Clark F. Grain 12 May 1975 35 p refs
(Grant NSF AER-74-00928)
(PB-252310/8; NSF/RA/N-75-251) Avail: NTIS HC $4.00 CSCL 10B

Low resistivity ZnO layers were obtained with quantum efficiencies of 50 percent to incident light and power efficiencies of 3 percent to incident monochromatic light were observed. Cells with areas of 10 sq cm and a life of 1 week were prepared. Both Pb3O4 and PbO formed rectifying contacts with all metals used and the SnO2 substrate. Ohmic gold contacts were successfully prepared on both doped and undoped Pb3O4 layers and the resistivity of Pb3O4 layers was reduced from 10 to the 11th power to 10 to the 7th power ohm-cm via doping and heat treatments. Spectral response measurements of the layers showed quantum efficiencies of 5-10 percent incident light. Power efficiencies were limited by the overly-high internal series resistance. GRA

N76-33676# Joint Center for Graduate Study, Richland, Wash.
INVESTIGATION OF LOW COST SOLAR CELLS BASED ON Cu2O Quarterly Progress Report, 1 Oct. - 31 Dec. 1975
Larry C. Olsen 1976 36 p refs
(Grant NSF AER-75-20501)
(PB-252301/7; NSF/RA-760061) Avail: NTIS HC $4.00 CSCL 10B

The growth of thin films of Cu2O in Cu/Cu2O backwall cell structures was studied. A system was established for controlled oxidation of copper. Samples of copper are placed in a quartz tube heated by an automatically controlled tube furnace, and subjected to an oxygen-nitrogen gas mixture to grow Cu2O layers. To avoid pits in the oxide films, the sample is cooled in a N2 stream. This approach results in lower resistivity oxide films without pits and allows better control of oxide thickness. Effects of oxidation temperature on grain size and growth rate were also studied. Furthermore, an experimental station was established for measurement of spectral collection efficiency, and several computer codes were developed including one for calculating solar collection efficiency for a given solar spectrum. Finally, an approach to calculating performance for an MIS cell was developed. GRA

N76-33677# West Virginia Univ., Morgantown. Dept. of Aerospace Engineering.
INNOVATIVE WIND MACHINES Six Month Report, 1 Mar. - 31 Aug. 1975
Richard E. Walters, Jerome B. Fanucci, John L. Loth, Nathan Ness, and G. Michael Palmer Sep. 1975 160 p refs
(Grant NSF AER-75-00367-000)
(PB-252617/6; NSF/RA/N-75-223; TR-47) Avail: NTIS HC $6.75 CSCL 10B

Theoretical and experimental research concerning the evaluation of two concepts for wind (energy conversion) machines are described. The first concept is that of a vortex concentrator: a high lift vertical airfoil in the ambient wind generates a trailing vortex which has its energy harnessed by a relatively small high speed turbine located just downstream of the wing tip. The device concentrates wind energy so that for a given size turbine the potential power output is greatly increased. The second concept described is that of a vertical axis panemone device with circulation controlled airfoils for the blades. GRA

N76-33678# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
ELECTROCHEMISTRY OF SOME NEW ALKALINE BATTERY ELECTRODES
David F. Pickett, Wayne S. Bishop, and Richard A. Marsh Wright-Patterson, AFB, Ohio AFAPL Feb. 1976 46 p refs (AF Proj. 3145)
(AD-A022952; AFAPL-TR-75-79) Avail: NTIS CSCL 10/3

New alkaline battery electrodes used in cells such as nickel oxide-cadmium, nickel oxide-hydrogen, nickel oxide-zinc, and silver oxide-zinc have been developed as a result of contracted and in-house research at the Air Force Aero-Propulsion Laboratory. Cathodic hydroxide precipitation techniques are used for preparation of nickel oxide and cadmium electrodes. Bipolar silver oxide-zinc electrodes are fabricated by spray deposition-sintering and vapor deposition techniques. Novel methods for preparation of dry charged nickel oxide electrodes for reserve type nickel oxide-zinc batteries are being investigated. One technique involves charging conventional sintered, vacuum impregnated electrodes then removing electrolyte with a distilled water wash. Drying is performed in vacuo. The plates yield rated capacity upon activation, but no long term dry storage data is available. Secondary nickel oxide electrodes, prepared by cathodic precipitation techniques, appear far superior to other nickel oxide electrodes because of their reduced thickening with charge-discharge cycling at deep depths of discharge and their good charge acceptance at high temperatures. The silver oxide-zinc electrode fabrication techniques have made construction of a multicell pile for high power applications feasible. Minor problems such as anomalous gassing have been incurred but appear capable of solution. GRA

N76-33679# RAND Corp., Santa Monica, Calif.
THE POTENTIAL OF INDIGENOUS ENERGY RESOURCES FOR REMOTE MILITARY BASES Interim Report
T. T. Connors, P. F. Morrison, C. C. Mow, and R. G. Salter Mar. 1976 141 p refs
(Contract DAHC15-73-C-0181; ARPA Order 189)
(AD-A022829; R-1798-ARPA) Avail: NTIS CSCL 10/2

An examination of the potential of solar radiation, wind, and ocean waves to provide thermal and electrical power to standard remote military bases. Sufficient energy is shown to be available in the North Atlantic, Indian, and Pacific Oceans, and the Caribbean to satisfy average remote base power requirements. A survey of indigenous energy technologies indicates that considerable research is needed to bring wave power recovery up to the level of solar and wind systems. An analytic computer model is used to show that indigenous energy systems are extremely costly, in part because of storage requirements, and that a mix of indigenous and conventional (petroleum) systems would be far less so. Since even a combined system is shown to exceed the cost of a pure conventional power supply, use of indigenous energy is justifiable only as a means of reducing the dependence of remote bases on petroleum fuels. Author (GRA)

N76-33680# General Electric Co., San Jose, Calif. Nuclear Energy Operational Planning.
FUTURE NEEDS FOR DRY OR PEAK SHAVED DRY/WET COOLING AND SIGNIFICANCE TO NUCLEAR POWER PLANTS Final Report
H. V. Clukey, M. J. McNelly, and R. C. Mitchell Feb. 1976 130 p Sponsored by EPRI
(PB-253630/8; EPRI-NP-150) Avail: NTIS HC $6.00 CSCL 13A

For nuclear installations in water scarce areas it appears that peak-shaved dry/wet cooling systems are more attractive than all-dry tower cooling unless water costs were to approach the high level of several cents per gallon. The differential cooling system evaluated cost of peak-shaved dry/wet cooling systems above wet towers is typically $20 to $30/kWe for steam turbines; whereas, dry towers can represent an incremental burden of as much as $80/kWe. Gas turbine (Brayton Cycle) systems show similar benefits from an evaporative heat sink to those for steam turbine cycles--lower cooling system evaluated costs for peak-shaved dry/wet cooling systems than for conventional wet towers. These cooling system cost differentials do not reflect total costs for Brayton Cycle gas turbine plants. Together these added costs and uncertainties may substantially exceed the dollar incentives available for development of the Brayton Cycle for power generation needs for water deficient sites. GRA

N76-33681# Utah Water Research Lab., Logan.
NUTRIENT DYNAMICS AND GAS PRODUCTION IN AQUATIC ECOSYSTEMS: THE EFFECTS AND UTILIZATION OF MERCURY AND NITROGEN IN SEDIMENT-WATER MICROCOSMS
D. B. Porcella, V. D. Adams, P. A. Cowan, S. Austrheim-Smith, W. F. Holmes, J. Hill, IV, W. J. Grenney, and E. J. Middlebrooks Nov. 1975 148 p refs
(Contract DI-14-31-0001-3942; OWRT Proj. B-081-UTAH(2)) (PB-250704/4; PRWG-121-1; W76-05246) Avail: NTIS HC $6.00 CSCL 08H

Sediment-water microcosms (sixteen) designed to allow complete gas, liquid, and solid mass balances of gases, nutrients, and mercury were studied under dark conditions or varying light intensity for a period of 189 days. Results indicated that the microcosm technique is a very sensitive method of analyzing microbial dynamics in sediment water systems. Gas quantity and composition changes were easy to monitor and were especially sensitive to light and nutrient variations. Nitrogen fixation occurred in all lighted systems and was adequate to insure that no nitrogen limitation occurred even though nitrogen limitation was imposed on the system. Sediments apparently did not act as a significant source of nitrogen. Iron and phosphorus were in excess and as such were closely linked as would be predicted on the basis of chemical equilibria. Non-equilibrium chemical behavior of such elements would apparently result only when appreciable amounts of the compound or element are utilized in growth. GRA

N76-33682# Office of Technology Assessment, Washington, D.C.
AN ANALYSIS OF THE IMPACT OF THE PROJECTED NATURAL GAS CURTAILMENTS FOR THE WINTER 1975-76
Nov. 1975 41 p refs
(PB-250623/6; OTA-E-13) Avail: NTIS HC $4.00 CSCL 21D

Natural gas curtailments have been a continuing and growing phenomena since 1970, and are projected for the winter of 1975-76 at a level that would cause severe constraints on economic activity. The objectives of this study are to determine the extent to which these projected curtailments reflect the actual situation and what the impacts and potential danger points might be as a result of the natural gas shortage. A list is presented of important issues which are intimately related to the overall problem of natural gas shortages and need to be addressed in determining its solution. GRA

N76-33683# Emerson Consultants, Inc., New York.
FUEL EFFICIENCY IMPROVEMENT IN RAIL FREIGHT TRANSPORTATION Final Report, Jun. - Dec. 1975
J. N. Cetinich Dec. 1975 92 p refs
(Contract DOT-TSC-1105)
(PB-250673/1; FRA/ORD-76-136; DOT-TSC-FRA-75-26) Avail: NTIS HC $5.00 CSCL 21D

Railroad diesel fuel conservation is becoming increasingly cost-effective. The price of diesel fuel has increased almost two and one-half times since the October 1973 Embargo. The estimated value of diesel fuel, if in short supply, is over 1 dollar a gallon. A comparison of the fuel performance of 10 selected railroads, before and after the Embargo, showed improvement in net-ton-miles hauled per gallon of diesel fuel. The most promising immediate avenue for conserving diesel fuel is designing train operating policies specifically to conserve fuel while continuing to provide desired schedule performance. The basic diesel locomotive now used was designed during an era of plentiful fuel supply at a relatively low price. GRA

N76-33684# Transportation Research Board, Washington, D.C.
ENERGY USE IN TRANSPORTATION: POTENTIAL FOR COOPERATIVE RESEARCH
H. W. Bruck 1975 148 p Sponsored by DOT
(PB-250503/0) Avail: NTIS MF $2.25; HC available from Transportation Research Board, 2101 Constitution Ave., N. W., Washington, D. C. 20418 CSCL 10A

Findings are outlined of a group of researchers sent by the Transportation Research Board, under contract with the U.S. Department of Transportation, to selected European countries and multinational organizations to inquire into the possibilities and prospects of research cooperation in the field of energy use in transportation. GRA

N76-33685# Geological Survey, Tallahassee, Fla. Water Resources Div.
PERSPECTIVE ON USE OF FRESH WATER FOR COOLING SYSTEMS OF THERMOELECTRIC POWERPLANTS IN FLORIDA Final Report
G. H. Hughes Dec. 1975 35 p refs Sponsored in part by Fla. State Dept. of Environmental Regulation
(PB-250937/0; USGS-WRD-76-005; USGS-WRI-75-43) Avail: NTIS HC $4.00 CSCL 10B

The cooling-water requirement for 3 types of cooling systems generally used in Florida is considered: cooling ponds, evaporative cooling towers, and once-through cooling. A distinction is made between the quantity of water withdrawn from a water supply for cooling purposes and the quantity of water that is consumed as a result of the cooling process. GRA

N76-33686# Army Construction Engineering Research Lab., Champaign, Ill.
TOTAL ENERGY AND TOTAL UTILITY SYSTEMS FOR CONSERVATION OF RESOURCES Interim Report, Jul. 1973 - Jun. 1974
Douglas C. Hittle Mar. 1976 34 p
(DA Proj. 4A7-6720-A-896)
(AD-A023244; CERL-IR-E-61) Avail: NTIS CSCL 10/1

This report describes the problems encountered in the feasibility assessment and design of total energy/total utility systems, outlines the general framework of a computational model for solving these problems and describes the data required to validate such a model. Author (GRA)

N76-33687# Energy Research Corp., Danbury, Conn.
DEVELOPMENT OF ZINC ELECTRODES AND INORGANIC SEPARATORS FOR LARGE SIZE SILVER-ZINC BATTERIES Final Technical Report, 4 Mar. 1974 - 31 Oct. 1975
Allen Charkey 17 Mar. 1976 21 p refs
(Contract N00024-74-C-5262)
(AD-A022467) Avail: NTIS CSCL 10/3

During the nineteen month period of this contract both 40Ahr and 850Ahr (NR-1) size silver-zinc cells were designed, fabricated and tested to evaluate improved zinc electrode structures and inorganic separators developed by ERC. The 40Ahr cell groups have completed cycling and have achieved 150-300 cycles depending on the cell construction. The NR-1 batteries have completed 150-300 days of testing on both float and deep discharge regimes with the testing continuing. Three NR-1 and three DSRV (525Ahr) cells have been fabricated with the most promising design and have been delivered to NAD-Crane for life test evaluation. The most promising design from data obtained in both 40Ahr and 850Ahr cells appears to be a combination of FSC and ERC 2002 inorganic separator with KT separator on the negative electrode. The various negative plate additives investigated did improve performance in cells with FSC separators but did not show an additional improvement when tested in cells with inorganic and FSC separators in combination. GRA

N76-33688# Energy Research Corp., Danbury, Conn.
NEW MATERIALS FOR FLUORO SULFONIC ACID ELECTROLYTE FUEL CELLS Interim Report, 7 Mar. - 7 Nov. 1975
Michael George and Bernard S. Baker Dec. 1975 26 p refs
(Contract DAAK02-75-C-0045; DA Proj. 1G7-627087-AH-267) (AD-A022466; ERC-0123-2I; IR-2) Avail: NTIS CSCL 10/2

Hydrogen-air fuel cells with platinum black electrodes and PTFE Matrices gave current densities approaching 100mA/sq cm with the monohydrate of TFMSA as the electrolyte. Electrolyte volatility and electrode flooding were shown to be limiting factors for cell performance. Initial performance results for dilute TFMSA electrolyte fuel cells indicated a more promising approach. Author (GRA)

N76-33689# Mallory (P. R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science.
SEALED PRIMARY LITHIUM-INORGANIC ELECTROLYTE CELL Quarterly Report, 1 Sep. - 30 Nov. 1975

A. N. Dey Apr. 1976 43 p refs
(Contract DAAB07-74-C-0109; DA Proj. 1S7-62705-AH-94)
(AD-A023437; ECOM-74-0109-7; QR-7) Avail: NTIS CSCL 10/3

Attention was focussed on the storability of the Li/SOCl2 D cell and the voltage-delay problem after investigating the explosion encountered on high rate discharge, short circuiting and overdischarge. The 45 C storage tests on the Li/SOCl2 hermetic D cells showed that the cells retained a substantial portion of their initial capacity even after 1 year at 45 C, when tested at 25 C at 0.25A. At high rates, there is a significant degradation of the cell capacity. The voltage-delay, though quite severe at high rates at both 25 and -30C, is not present at low rates (0.25A). Furthermore, it appears that partial discharge and intermittent anode pulsing tend to alleviate the voltage-delay problem for low rates of discharge. At high rates the delay is still quite appreciable. An SEM investigation on the Li anode film is being made in an effort to increase our understanding of the mechanism of the voltage-delay. GRA

N76-33690# GTE Labs., Inc., Waltham, Mass.
SEALED LITHIUM INORGANIC ELECTROLYTE CELL Quarterly Report, 1 Sep. - 31 Dec. 1975
N. Marincic and A. Lombardi Mar. 1976 42 p refs
(Contract DAAB07-74-C-0108; DA Proj. 1S7-62705-AH-9)
(AD-A023458; ECOM-74-0108-7; QR-7) Avail: NTIS CSCL 10/3

The effects of iron impurities in the electrolyte on the lithium anode passivation have been studied further, using both the standard cell hardware and the isolated cell components within a glass cell arrangement. Cold rolled steel was found stable in the inorganic electrolyte if it was held strictly at the potential of lithium. The slightest deviation of the potential from this value resulted in severe corrosion, generated iron species in the solution, and caused the passivation effects described in previous reports. A large area of cold rolled steel cans, exposed to the electrolyte in the present type of cell construction of an appreciable distance from the contact with lithium, appears to form dissolution sites generating more than tolerable amounts of iron in the solution. For this reason, the idea of building the large cells with cold rolled steel hardware will have to be abandoned. Attention was gradually switched to studies of stainless steel as the cell hardware. GRA

N76-33691# EIC, Inc., Newton, Mass.
SULFUR-BASED LITHIUM-ORGANIC ELECTROLYTE SECONDARY BATTERIES Final Report, 3 Dec. 1973 - 29 Aug. 1975
Gerhard L. Holleck, Joseph R. Driscoll, and Fred S. Shuker Mar. 1976 175 p refs
(Contract DAAB07-74-C-0072; DA Proj. 1T1-61102-A-34A)
(AD-A023496; C-405; ECOM-74-0072-F) Avail: NTIS CSCL 10/3

The overall aim of this program was the development of a rechargeable lithium battery utilizing an organic solvent. Specifications included operation over the range -40 to +160 F (-40 to +70 C), energy density approaching 100 Whr/lb, a cycle-life in excess of 500, and high charge retention. A system meeting all these specifications would represent a considerable advance in the state of the art. An analysis of possible alternatives suggested the likelihood of developing such batteries with positive electrodes based on sulfur. Two general classes are promising: soluble sulfur positives, and positives based on higher sulfides of transition metals, particularly on sulfur-rich compounds of titanium, niobium and vanadium. Initially, both systems were investigated. Then, since only one of the two approaches towards sulfur based cathodes could be continued within the scope of this investigation, it was decided to concentrate on the transition metal sulfides as they have more immediate prospects for practical use. GRA

N76-33692# Battelle Columbus Labs., Ohio.
DEVELOPMENT OF AN INTEGRATED ENERGY VOCABULARY Final Report, Apr. 1975 - Feb. 1976
R. T. Niehoff Feb. 1976 37 p refs Sponsored by NSF
(PB-253781/9) Avail: NTIS HC $4.00 CSCL 05B

Work on an integrated energy vocabulary is discussed. Vocabularies from 10 information systems are employed. A broad definition of energy is formulated and used as a selection criterion. GRA

N76-33693# Delaware Univ., Newark. Inst. of Energy Conversion.
INTERNATIONAL WORKSHOP ON CADMIUM SULFIDE SOLAR CELLS AND OTHER ABRUPT HETEROJUNCTIONS
K. W. Boer and J. D. Meakin Oct. 1975 609 p refs Workshop held at Newark, Del., 30 Apr. - 2 May 1975
(Grant NSF AER-75-15858)
(PB-252297/7; NSF/RA/N-75-289) Avail: NTIS HC $16.25 CSCL 10B

A workshop was held to review work on CdS/Cu2S solar cells, to identify areas of little knowledge, and to formulate programs to solve identified problems. Fundamental theories of heterojunctions and specifically the CdS/Cu2S cell were reviewed. The application of materials science to the cell was investigated to understand cell operation based on structural knowledge. Production and economic aspects of cadmium sulfide solar cells are also presented. GRA

N76-33694# Delaware Univ., Newark. Inst. of Energy Conversion.
RESEARCH DIRECTED TO STABLE HIGH EFFICIENCY CdS SOLAR CELLS Semiannual Progress Report, 1 Jul. - 31 Dec. 1975
J. D. Meakin Mar. 1976 103 p refs Sponsored by NSF
(PB-252295/1; NSF/RA-760058;
NSF/RANN/AER72-03478-A04/PR-75) Avail: NTIS HC $5.50 CSCL 10B

Research progress indicates that the efficiency of cells has continuously improved over the contract period. An extensive matrix of experiments defined the influence of CdS deposition parameters on cell characteristics. Routine Cu(x)S stoichiometry measurements were made and the production and reduction of oxides of copper during barrier and post barrier treatments were established. Extensive spectral and capacitance studies are reported. Transmission and scanning electron microscope studies of Cu2S formation and morphology increased substantially the understanding of cell characteristics. Preliminary results using mixed zinc-cadmium sulfides are reported; and an expected increase in open circuit voltage was achieved. GRA

N76-33695# Delaware Univ., Newark. Inst. of Energy Conversion.
PHOTOVOLTAICS IN HETEROJUNCTIONS, PARTICULARLY CdS/Cu2S (DIRECT SOLAR ENERGY CONVERSION FOR LARGE SCALE TERRESTRIAL USE)
A. Rothwarf Jun. 1975 46 p refs
(Grant NSF AER-72-03478-A03)
(PB-252286/0; NSF/RA/N-75-286;
NSF/RANN/AER72-03478-A03/TR-75) Avail: NTIS HC $4.00 CSCL 10B

An overview of the operation of the Cu2S-CdS solar cell is given in terms of heterojunction theory. The factors determining the open circuit voltage, fill factor, and short circuit current are treated. The short circuit current's dependence on the mode of operation of the cell, on the Cu2S parameters: absorption coefficient, diffusion length, thickness, grain size, drift fields, and surface recombination and on the CdS parameters: space charge field, mobility, and interface recombination velocity is discussed. The dependence on the open circuit voltage on the difference in work functions between Cu2S and CdS and the mechanisms for the dark diode current is shown. GRA

N76-33696# Delaware Univ., Newark. Inst. of Energy Conversion.
LIGHT GENERAL CURRENT DENSITIES IN THE Cu2S-CdS SOLAR CELLS (DIRECT SOLAR ENERGY CONVERSION FOR LARGE SCALE TERRESTRIAL USE)
A. Rothwarf May 1975 54 p refs
(Grant NSF AER-72-03478-A03)
(PB-252285/2; NSF/RA/N-75-183;
NSF/RANN/AER72-03478-A03/TR-75) Avail: NTIS HC $4.50 CSCL 10B

Expressions are derived for the light generated current densities in the Cu2S-CdS solar cell for its four modes of operation (frontwall, backwall, and frontwall and backwall reflection). The

parameters involved are alpha, the absorption coefficient in Cu2S, L the electron diffusion length, d the thickness of the Cu2S layer, S the surface recombination velocity, F the drift field in Cu2S, and phi the incident photon flux. The expressions are numerically evaluated for various cases to obtain collection efficiencies and expected values of the current density. The calculated values are in agreement with measured quantities on actual cells. Other factors which can influence the measured short circuit current in the cell are also discussed. GRA

N76-33697# National Bureau of Standards, Washington, D.C. Building Environment Div.
GOVERNMENT ACTIVITIES AND REGULATIONS FOR BUILDINGS ON ENERGY SAVING STANDARDS. A LOOK AT WHAT VARIOUS AGENCIES HAVE DONE AND INTEND TO DO FOR ENERGY CONSERVATION Final Report
Paul R. Achenbach Dec. 1975 8 p Repr. from Heating/Piping/Air Conditioning, v. 47, Dec. 1975 p 13, 41-46
(PB-252399/1) Avail: NTIS HC $3.50 CSCL 13A

Existing documents relating to retrofit are identified, along with documents in development for both new and extant buildings with potential impact on regulations, standards, and codes, if the energy shortage persists. GRA

N76-33698# Maryland Univ., College Park. Dept. of Mechanical Engineering.
WORKSHOPS ON SOLAR COLLECTORS FOR HEATING AND COOLING OF BUILDINGS Final Summary Report, 15 Aug. 1974 - 31 Dec. 1975
Stephen L. Sargent Dec. 1975 13 p
(Grant NSF AER-74-24639)
(PB-252977/4; NSF/RA/N-75-292) Avail: NTIS HC $3.50 CSCL 13A

This report concentrates on the mechanics of organizing and running the workshop and publishing the proceedings, in hope that this discussion will be useful to people planning future solar energy workshops. GRA

N76-33699# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
AN APPLICATION OF A GENERALIZED MANAGEMENT INFORMATION SYSTEM TO ENERGY POLICY AND DECISION MAKING: THE USER'S VIEW
John J. Donovan, Louis M. Gutentag, Stewart E. Madnick, and Grant N. Smith May 1975 25 p refs Submitted for publication Sponsored by New England Regional Commission, Boston
(PB-252980/8; MIT-EL-75-008) Avail: NTIS HC $3.50 CSCL 10A

An approach to the development and use of management information systems is presented. This approach is particularly applicable to systems that: have several types of users with varying degrees of sophistication; have complex or changing security requirements; exhibit complex and changing interrelationships in data; must be built quickly and inexpensively; have complex data validation requirements; and/or must meet changing needs. The type of system described is hierarchical because it may be accessed at distinct levels: A casual user has high level primitives to work with, while an experienced user has more flexible but more detailed low-level primitives. Hierarchical systems also provide for ease of debugging, independence of hardware, and a basis for investigating properties of completeness, integrity, correctness, and performance. GRA

N76-33700# Midwest Research Inst., Kansas City, Mo.
ENERGY CONSERVATION IMPLICATIONS OF MASTER METERING, VOLUME 1 Final Report
Gordon E. Gross, Richard D. Harper, and Steve Ahlstrom Washington FEA Oct. 1975 84 p refs 2 Vol.
(Contract FEA-C-04-50067-00)
(PB-254322/1; FEA/D-76/110-Vol-1) Avail: NTIS HC $5.00 CSCL 10A

Master metering of electrical service in apartment and office buildings was investigated. The objectives of the study were to determine: (1) the difference between electrical energy consumption by tenants with master metered electric service and those who must pay individual electric bills; (2) the extent and trends of the use of master metering of electrical service in apartment and office buildings; (3) the economic and other factors which influence the initial selection or later conversion to master or individual metering; and (4) to provide and evaluate policy alternatives which could control the practice of master metering. GRA

N76-33701# Midwest Research Inst., Kansas City, Mo.
ENERGY CONSERVATION IMPLICATIONS OF MASTER METERING. VOLUME 2: APPENDICES Final Report
Gordon E. Gross, Richard D. Harper, and Steve Ahlstrom Washington FEA Oct. 1975 146 p 2 Vol.
(Contract FEA-C-04-50067-00)
(PB-254323/9; FEA/D-76/111-Vol-2) Avail: NTIS HC $6.00 CSCL 10A

The seven appendices contain the following: (1) examples of electricity rate structures; (2) names and addresses of information sources used in this study; (3) responses from 47 state public service commissions on their stand on master metering; (4) comparison of electricity consumption between master-metered apartments and individual-metered; (5) extent of master metering from the Census of Housing 1970; (6) reports and information on load and consumption studies; and (7) utility and real estate management comments. GRA

N76-33702# Kentucky Univ., Lexington. Inst. for Mining and Minerals Research.
SYNTHETIC OIL FROM COAL Semiannual Report, 1 Jul. - 31 Dec. 1975
Richard I. Kermode Dec. 1975 40 p Sponsored in part by NSF
(PB-253733/0; IMMR10-PD8-75; SAR-2) Avail: NTIS HC $4.00 CSCL 07A

A flowsheet for the hydrogen production process including all columns, tanks, heat exchangers, etc., was completed. Material and energy balances for each piece of equipment were also completed for the case of hydrogen produced at 1000 psi and a coal feed to the partial oxidizer. All equipment sizes and materials of construction, as well as the capital cost, were specified for this case. The single-stage low-temperature carbonizer operated continuously for five hours or less. Improved understanding of the variables affecting the batch flotation column operation centered on the temperature distribution along the length of the column and its effect on the extent of separation. Other variables studied were the amount of cresol present in the solvent oil, the inlet ash concentration, the diffuser pore size, and the pre-heating time. The trace element study progressed from tetralin solvation alone to hydrogen plus tetralin solvation. GRA

N76-33703# Rutgers Univ., New Brunswick, N.J. Dept. of Electrical Engineering.
SILICON SCHOTTKY PHOTOVOLTAIC DIODES FOR SOLAR ENERGY CONVERSION Annual Report, 1 Jan. - 31 Mar. 1976
Wayne A. Anderson Apr. 1976 36 p refs
(Grant NSF AER-73-03197)
(PB-253338/3; NSF/RANN/SE/AER73-03197/PR-76; NSF/RA-760077) Avail: NTIS HC $4.00 CSCL 10B

Further refinement of the fabrication process led to reproducible construction of Schottky solar cells on silicon. Values of V sub oc = 0.55V, F + 0.7, and J sub sc = 22mA/sq cm are routinely obtained. These data now predict a practical efficiency limit > 12%. Surface state, 1-V, and solar data can now be related to permit better understanding of device operation. Environmental studies and NASA simulator measurements are continuining. Optical properties of thin Ag, Cu, and Cr films were determined to improve the AR design. GRA

N76-33704# General Electric Co., Philadelphia, Pa.
SOLAR HEATING EXPERIMENT ON THE GROVER CLEVELAND SCHOOL, BOSTON, MASSACHUSETTS Annual Report
15 Jul. 1975 156 p
(Contract E(11-1)-2626)
(PB-253303/2; NSF/RA/N-75-272) Avail: NTIS HC $6.75 CSCL 13A

Data obtained during the first full year's operation of an industrial solar heating system of pilot plant scale located at Grover Cleveland Middle School (Boston) are presented. Included are a brief description of the system, operational data, maintenance

data, problem areas, and major conclusions drawn from the experiment. GRA

N76-33705# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
THERMIC CONTROLS TO REGULATE SOLAR HEAT FLUX INTO BUILDINGS Final Report, 1 Jul. 1975 - 31 Oct. 1976
Shawn Buckley 2 Apr. 1976 75 p refs
(Grant NSF GI-43897)
(PB-253345/3; NSF/RANN/SE/GI-43897/FR-76-3; NSF/RA-760076) Avail: NTIS HC $4.50 CSCL 10A

Thermic diode solar panels are a new method of heating buildings using solar energy. Each panel combines all the necessary elements of a complete solar energy system (collector, controls, storage, heat exchangers and ducting) into a 4ft x 8ft module. The economics of thermic panels were determined using a computer simulation of a typical house under actual weather conditions for eight different climate types. The resulting heat savings over the life of the panel are compared to the panel's installed cost. Thermic panels are compared also to other typical solar heating systems such as air heating and water heating, active and passive. Since the panels can be used for cooling a building with only a simple modification, an analysis of their cooling performance is presented. GRA

N76-33706# IIT Research Inst., Chicago, Ill.
TECHNOLOGICAL PROBLEMS OF BURNING LOW-SULFUR WESTERN COAL Final Report
Linda L. Huff and Willard R. Haas 31 Dec. 1975 64 p refs
(Contract EPA-68-01-3163)
(PB-252650/7; IITRI-C6333-C04-3; EPA-905/2-76-001) Avail: NTIS HC $4.50 CSCL 10B

The burning of low-sulfur western coals in boilers designed for bituminous fuels can result in operational problems. Resolution of these problems requires modification of the existing systems. In examining five boiler types, cyclone, pulverized coal, spreader stoker, cross-feed, and under boilers, the necessary conversion factors were identified. To understand the significance of operational problems in burning western coals, a background on coal characteristics and boiler design is presented. As a basis for discussion of the experiences in industrial and power-generating usage of western coals. GRA

N76-33707# Naval Nuclear Power Unit, Fort Belvoir, Va.
OPERATING REPORT FOR RADIOISOTOPIC THERMOELECTRIC GENERATORS OF THE US NAVY, VOLUME 9, NUMBER 1, 1 OCTOBER 1974 - 31 DECEMBER 1975
31 Dec. 1975 108 p refs
(AD-A024531) Avail: NTIS CSCL 10/2

The objective of this Operating Report is to serve as a vehicle for the accumulation and dissemination of information concerning the application and operation of radioisotopic thermoelectric generators (RTGs) within the Navy. Unless specifically identified as an engineering evaluation, items contained in this report are presented as an impartial collection of facts, observations and other information. Author (GRA)

N76-33708# Smithsonian Science Information Exchange, Washington, D.C.
INFORMATION ON INTERNATIONAL RESEARCH AND DEVELOPMENT ACTIVITIES IN THE FIELD OF ENERGY
David F. Hersey May 1976 370 p
(Grant NSF AER-74-20678)
(PB-254315/5; NSF/RA-760057) Avail: NTIS HC $10.50 CSCL 10A

This directory is the product of a data collection effort undertaken by the Smithsonian Science information Exchange on behalf of an interagency committee formed under the U.S. State Department to provide international cooperation in energy research and development. Included is information covering 1,766 ongoing and recently completed energy research projects conducted in Canada, Italy, the Federal Republic of Germany, France, the Netherlands, the United Kingdom and 25 other countries. In addition to the title and test of project summaries, the directory contains the following indexes: subject index, investigator index, performing organization index, and supporting organization index. GRA

N76-33709# Alaska Univ., College. Geophysical Inst.
STUDY OF ALASKAN WIND POWER AND ITS POSSIBLE APPLICATIONS Final Report, 1 May 1974 - 30 Jan. 1976
Tunis Wentink, Jr. Feb. 1976 178 p refs
(Grant NSF AER-74-00239-A01)
(PB-253339/6; NSF/RANN/SE/AER74-00239/FR-76; NSF/RA-760069) Avail: NTIS HC $7.50 CSCL 10B

Alaska's wind power potential, both meteorological and applied is determined. The world's wind potential is also treated. Wind literature is surveyed, and new wind measurements featuring vertical profiles of velocity are reported. Analytical formulations of measured and synthetic wind spectra are detailed. Local energy use patterns and storage systems are considered; the economics of windmill use, fuel costs, and fossil based electricity are treated. GRA

N76-33710# General Electric Co., Schenectady, N.Y.
COMPARATIVE STUDY AND EVALUATION OF ADVANCED CYCLE SYSTEMS, REPORT ON PHASE 1
May 1976 276 p
(PB-254392/4; EPRI-AF-158) Avail: NTIS HC $9.25 CSCL 10B

Technical and economic characteristics of various advanced energy conversion systems and research and development requirements, including costs, necessary to establish their commercial feasibility are discussed. Systems studied include recuperative gas turbine, combined cycle gas turbine, advanced steam, closed cycle gas turbine, open cycle magnetohydrodynamics (MHD), closed cycle plasma MHD, liquid metal MHD, thermionic, and fuel cell (low temperature). GRA

N76-33711# Westinghouse Electric Corp., Lima, Ohio. Aerospace Electrical Div.
DESIGN AND FABRICATION OF A 100 KW PERMANENT MAGNET GENERATOR Final Technical Report
E. F. Hammond, Jr. Jul. 1974 259 p refs
(Contract DAAK02-71-C-0177)
(AD-A024261; WAED-74) Avail: NTIS CSCL 10/2

The objectives of this contractual effort were to: design and develop a 100 KW permanent magnet generator (PMG) to determine the applicability of samarium cobalt to excitation in a high speed generator; design and develop rotor to contain the magnets; investigate handling techniques for the samarium cobalt magnets; gain test experience and data for possible future use of the machine in a direct-connected turbine-alternator set; and develop a hot isostatic pressure (HIP) weldment as a back-up to the EB welded rotor ring. The PMG design generally followed the preliminary design of the feasibility study. Major problems were encountered on the present program to the initial EB and HIP weldments, but these yielded to an adequate rotor weldment in the end that was capable of rotation to at least 61,300 rpm. This weldment was used to fabricate a complete rotor for the PMG. Funding limitations prevented the completion of the 100 KW PMG and most of its major subassemblies. GRA

N76-33712# Tetra Tech, Inc., Arlington, Va.
A PRELIMINARY ASSESSMENT OF THE TIDAL POWER POTENTIAL AT TWO SITES IN THE VICINITY OF CUTLER, MAINE
Bernard LeMehaute Apr. 1976 44 p
(Contract N00014-76-C-0239)
(AD-A023824; TETRAT-A-642-76-238) Avail: NTIS CSCL 10/2

This is a preliminary assessment of Machias Bay and Little Machias Bay near Cutler, Maine, as potential sites for a tidal power plant to provide electrical power for nearby Naval radio stations. This report contains a discussion of the power requirements and energy potential at these sites, tidal power plant systems which might be used, and economic considerations. The analysis consists primarily of a comparison with the operating tidal power plant at Rance, France. Author (GRA)

N76-33713# Tetra Tech, Inc., Arlington, Va.
ASSESSMENT OF THE STATE-OF-THE-ART OF FEEDING WIND-GENERATED ELECTRICITY INTO UTILITY POWER GRIDS
J. J. Reed 8 Mar. 1976 29 p refs
(Contract N00014-76-C-0239)

(AD-A024278; TETRAT-A-642-76-240) Avail: NTIS CSCL 10/2

The current state-of-the-art of supplying wind-generated electric power directly into utility power grids is assessed. The requirement for inclusion of an energy storage capability is addressed, and energy storage concepts and availability are summarized. Economic data excerpted from the literature is included. Author (GRA)

N76-33714# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

SAS-C SOLAR ARRAY DEVELOPMENT DYNAMICS

C. E. Williams Aug. 1975 65 p refs

(Contract N00017-72-C-4401)

(AD-A022713; APL-JHU-TG-1281) Avail: NTIS CSCL 10/1

SAS-C has four segmented solar arrays, each consisting of three contiguous, spring-connected solar panels. Array deployment involves unfolding from an inverted 'N' configuration to an extended planar configuration. The deployment dynamics of this type of mechanical system are such that the possibility of damage to any one of the four solar arrays, because of undesirable deployment dynamics, is quite significant. Minimizing this possibility has been the objective of an analytical and experimental investigation. In the analytical investigation, digital computer simulations were used to examine many aspects of the deployment dynamics. The simulations resulted in a set of array spring and mass parameters that minimize deployment damage potential. Experimental investigations consisted of spacecraft despin an array deployment in a vacuum chamber. The report presents analytic and experimental results. Acceptable agreement was obtained between the vacuum test data and the digital simulation. All of the results indicate that the expected deployment dynamics are acceptable for flight. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N76-33715*# Morehouse Coll., Atlanta, Ga. Dept. of Chemistry.

PRODUCTS OF THE REACTION OF CHLORINE ATOMS AND OZONE Final Report

J. H. Hall, Jr., C. W. Merideth, S. Bhatia, W. A. Guillory, and J. N. Gayles Washington NASA Oct. 1976 14 p refs Prepared for JPL

(Grant NGL-11-008-001; Contract JPL-953841)

(NASA-CR-2756; M-186) Avail: NTIS HC $3.50 CSCL 13B

Preliminary matrix-isolation infrared spectroscopic studies of the gas-phase reaction of chlorine atoms and ozone are reported. It was shown that the major product of the reaction is the symmetric OClO radical, while very little of the asymmetric ClOO radical is produced. It was also shown that the presence of O2 enhances the OClO production and the ClOO is the primary product in the reaction of Cl atoms and pure O2. The radical ClO was observed for the first time in a gas-phase reaction of Cl and O3. A mechanism for these observations is proposed. Author

N76-33716*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANALYSIS OF ATMOSPHERIC OZONE MEASUREMENTS MADE FROM A B-747 AIRLINER DURING MARCH 1975

James D. Holdeman and Phillip D. Falconer Washington Oct. 1976 32 p refs

(NASA-TN-D-8311; E-8765) Avail: NTIS HC $4.00 CSCL 04A

Measurements of atmospheric ozone in the upper troposphere and lower stratosphere made during March 1975 as part of the NASA Global Atmospheric Sampling Program are reported and analyzed. The interrelationships between the ozone mixing ratio and geographical and meteorological parameters are examined in several case studies. The ozone data correlate well with the difference between the flight altitude and the height of the tropopause, as obtained from National Meteorological Center gridded data. The distribution of ozone mixing ratios with latitude at an altitude of 11 + or - 0.5 km shows a poleward increase and large variability at latitudes greater than 30 deg N in agreement with published mean ozone levels from the North American ozone sonde network. Author.

N76-33717# Trans-Tech Translations, Seattle, Wash.

STUDIES OF THE PROPAGATION OF CONTAMINATED AIR TRAILS IN THE ATMOSPHERE. REPORT OF RESULTS: JULY 1973 - JUNE 1974, PART 1

K. J. Vogt, H. Geiss, M. Horbert, N. Nordsieck, G. Polster, and F. Rohloff Oct. 1975 86 p refs Transl. into ENGLISH of West German Report Jul-1143-ST Prepared for Battelle Northwest Labs. Sponsored by ERDA

(BNWL-TR-158-Pt-1; Jul-1143-St) Avail: NTIS HC $5.00

The following experimental concepts are discussed: portable sampling network; determination of vertical concentration distribution in contaminated air trails; and simultaneous tests. The following propagation tests are described: documentation and meteorological characterization of tracer experiments; measuring results and determination of propagation parameters; comparison of different evaluation methods; determination of mean class values of propagation parameters; statistics of results of tests with 50 m emission height; and measurement of time dependence of concentration distribution close to the ground of a contaminated air trail with changes in wind direction. ERA

N76-33718# Oak Ridge National Lab., Tenn.

ASSESSMENT OF THE MICROCOSM AS A TOOL FOR ESTIMATION OF ENVIRONMENTAL TRANSPORT OF TOXIC MATERIALS

S. Draggan Aug. 1975 18 p refs Presented at Ann. Meeting of the Ecological Soc. of Am. with the Am. Inst. of Biological Sci., Corvallis, Oreg., 17 Aug. 1975 Sponsored by ERDA

(CONF-750838-2) Avail: NTIS HC $4.00

Increases in toxic chemical dissipation make their control in the environment desirable. Environmental control of these substances requires thorough understanding of the functioning of ecosystems potentially receiving chemical input, and of the behavior and fate of released chemicals. Terrestrial microcosms are useful tools in chemical fate studies; however, critical assessment of their ability to simulate ecosystem processes has been limited. A rationale for evaluating the utility of microcosms for prediction of chemical fate in natural ecosystems is provided. Author (ERA)

N76-33719# Sandia Labs., Albuquerque, N.Mex.

HEAVY METALS IN ESTUARINE BENTHIC ORGANISMS AND SEDIMENTS: DATA AND MODEL

J. R. Wayland, J. H. Baker, J. T. Ivy, and C. A. Bedinger, Jr. 5 Sep. 1975 32 p refs Presented at 3d ERDA Environ. Protection Conf., Chicago, 23 Sep. 1975 Sponsored by ERDA

(SAND-75-5869; Conf-750967-14) Avail: NTIS HC $4.75

A dynamic model was developed in close association with a detailed environmental surveillance program of an estuarine ecosystem. The program and model traces the heavy metals from release into the water column and subsequent interactions between the air-water interface, pelagic zone, and sediments. The interaction between phytoplankton, zooplankton, benthic organisms, and predators is accounted for. The results of the calculations are compared to measurements taken in an estuarine ecosystem over a two-year period. Author (ERA)

N76-33720# California Univ., Livermore. Lawrence Livermore Lab.

DEVELOPMENT OF AN AIR POLLUTION MODEL FOR THE SAN FRANCISCO BAY AREA, VOLUME 1

M. C. MacCracken, ed. and G. D. Sauter, ed. 1 Oct. 1975 227 p refs Sponsored by ERDA

(UCRL-51920-Vol-1) Avail: NTIS HC $8.00

The development and verification of a regional air quality model for the San Francisco Bay Area for use as an operational tool by the local air pollution control agency, the Bay Area Air Pollution Control District (BAA PCD), were completed. With source emission and meteorological information gathered by the BAAPCD and aircraft measurements taken by the NASA Ames Research Center, results from the Livermore Regional Air Quality (LIRAQ) model compared satisfactorily with observations of carbon monoxide and photochemical pollutants. The LIRAQ model can

be accessed easily by teletype and simulation runs set up on the Lawrence Berkeley Laboratory computer system. With the completion of the project, the LIRAQ model is ready for use by the BAAPCD in its studies of air quality, land use, and control strategy assessment. Volume I of the final report presents a comprehensive overview of the project and its accomplishments. Author (ERA)

N76-33721# Oak Ridge National Lab., Tenn. Computer Sciences Div.

COMPREHENSIVE ATMOSPHERIC TRANSPORT AND DIFFUSION MODEL

Walter M. Culkowski (NOAA, Oak Ridge, Tenn.) and Malcolm R. Patterson Apr. 1976 117 p refs

(Contract W-7405-eng-26; Grant NSF AEN-72-01243-A03)

(ORNL/NSF/EATC-17) Avail: NTIS HC $6.00

An atmospheric transport model is described that includes the effect of aerodynamic roughness on dispersion constants, clarifies the roles of the terminal velocity and deposition velocity, incorporates a tilting plume for heavy particulates, and includes an episodic calculation of exposure maxima. This model also limits the maximum value of the dispersion constants in order to retain the emitted material in the planetary boundary layer. The structure of the program was modularized in order to clarify the flow of calculation and allow more flexibility. Values for atmospheric concentration as well as both wetfall and dryfall deposition are calculated. The model is applied to the vicinity of three power plants, and correlations between model predictions and observed values are presented. ERA

N76-33722# Oak Ridge National Lab., Tenn.

METHODOLOGY FOR CALCULATING RADIATION DOSES FROM RADIOACTIVITY RELEASED TO THE ENVIRONMENT

G. G. Killough, comp. and Larry R. McKay, comp. Mar. 1976 510 p refs

(Contract W-7405-eng-26)

(ORNL-4992; Publ-660) Avail: NTIS HC $12.50

A compilation of the principle environmental transport and dosimetry models developed, adapted, and implemented is presented. The transport of released radioactivity through the natural environment is discussed in four sections: atmospheric dispersion, resuspension of material by wind action, terrestrial transport, and movement of material in underground water seepage. The discussion of dose to man and biota is divided into internal and external exposure sections. A developmental model (CONDOS) which estimates the dose to a population resulting from the manufacture, storage, distribution, use, and disposal of consumer products which contain radioactivity is described. Numerous tables are included. Author (ERA)

N76-33723# Stockholm Univ. (Sweden). Inst. of Meteorology.

ATMOSPHERIC DEPOSITION DUE TO LONG AND SHORT DISTANCE SOURCES WITH SPECIAL REFERENCE TO WET AND DRY DEPOSITION OF SULPHUR COMPOUNDS AROUND AN OIL FIRED POWER PLANT

Lennart Granat and Rolf Soederlund May 1975 152 p refs Sponsored in part by Stenungsund power plant authorities

(Contracts SWED-EPB-7-117/73-DNR-810-7-73; GO-0223-051)

(AC-32) Avail: NTIS HC $6.75

The additional yearly deposition of sulfur and acid from a large sulfur dioxide source (the power plant at Stenungsund on the West coast of Sweden) was estimated and compared with the regional deposition from distant anthropogenic emissions. The estimate of wet deposition was based on a number of daily measurements while the dry deposition was calculated from sulfur dioxide concentration in the plume (obtained from a dispersion model) at various distances with forest absorption rate taken from the literature. Dry deposition provided the most significant contribution while wet deposition was of little significance. The cumulative effect of a great number of S-sources in the same area was considered. A preliminary estimate showed that some 10 - 20% of the wet and dry deposition may be due to Swedish sources although much work is required before one can be conclusive in this regard Author (ESA)

N76-33724# Loughborough Univ. of Technology (England). Dept. of Transport Technology.

TRAFFIC NOISE PREDICTION WITH PARTICULAR REFERENCE TO FREE-FLOW ROAD TRAFFIC

David Brown Aug. 1975 41 p refs Sponsored by Sci. Res. Council

(TT-7507) Avail: NTIS HC $4.00

Predictive equations for road traffic noise intensity and duration were derived from purely analytical considerations and are further developed by the inclusion of a noise peak level statistical model derived from published data. The resulting equations are expressed in terms of commonly used traffic parameters, and tested against measured data for a wide range of conditions. Author (ESA)

N76-33725# Loughborough Univ. of Technology (England). Dept. of Transport Technology.

A MODEL FOR THE PREDICTION OF NOISE LEVELS ARISING FROM TYPICAL AIRPORT OPERATIONS

F. K. I. Hirji and D. M. Waters Jul. 1975 130 p refs Sponsored by Sci. Res. Council

(TT-7511) Avail: NTIS HC $6.00

A noise exposure prediction method requiring a minimum of information on aircraft movements was developed for airport noise. A standard case was defined which relates to a fully developed regional airport, the noise contours of which are presented. In order to make comparisons and combinations with other possible noise sources, the noise exposure was calculated in mean energy level units as well as using the conventional noise and number index. The new U.S. unified unit, the day/night mean energy level was also computed in an approximate manner. The resulting noise contours were found to extend over considerably greater areas than those defined in the U.S. housing and urban development guidelines, casting doubt on the guidelines' usefulness as a planning tool. Author (ESA)

N76-33726# Environmental Protection Agency, Dallas, Tex. Region 6.

HYDROCARBON/PHOTOCHEMICAL OXIDANT CONTROL STRATEGY FOR THE STATE OF TEXAS Final Report

Jan. 1976 220 p refs

(PB-253689/4; EPA-906/9-76-001) Avail: NTIS HC $7.75 CSCL 13B

The results of a reevaluation of the Texas photochemical oxidant control plan were presented and specific control strategies for each Texas area which exceeds the oxidant standard were recommended. The purpose of the reevaluation was to resolve technical questions that had arisen on the original November 1973 EPA plan as a result of litigation. GRA

N76-33727# Environmental Protection Agency, Washington, D.C. Effluent Guidelines Div.

DEVELOPMENT DOCUMENT FOR BEST TECHNOLOGY AVAILABLE FOR THE LOCATION, DESIGN, CONSTRUCTION AND CAPACITY OF COOLING WATER INTAKE STRUCTURES FOR MINIMIZING ADVERSE ENVIRONMENTAL IMPACT Final Report

Devereaux Barnes Apr. 1976 270 p refs

(PB-253573/0; EPA-440/1-76-015-a) Avail: NTIS HC $9.00 CSCL 13B

The findings of an extensive study were presented, dealing with the available technology for the location, design, construction, and capacity of cooling water intake structures for minimizing adverse environmental impact. This was done to comply with and to implement Section 316(b) of the Federal Water Pollution Control Act Amendments of 1972. GRA

N76-33728# EG and G Washington Analytical Services Center, Inc., Rockville, Md.

DESIGN AND TESTING OF A PROTOTYPE AUTOMATIC SEWER SAMPLING SYSTEM Final Report

Philip E. Shelley Mar. 1976 109 p refs

(Contract EPA-68-03-0409)

(PB-252613/5; EPA-600/2-76-006) Avail: NTIS HC $5.50 CSCL 13B

A brief review of the characteristics of storm and combined sewer flows is given, followed by a discussion of the requirements for equipment to sample them, noting features that are desirable

in such equipment and problem areas. The prototype sampler is described from an installation and operation viewpoint, and the results of preliminary field testing are discussed. The device was also tested under controlled laboratory conditions and found to be capable of gathering reasonably representative samples (i.e., within 10%) over a fairly wide range of flow characteristics. GRA

N76-33729# Environmental Protection Agency, Washington, D.C. Office of Research and Development.
OFFICE OF RESEARCH AND DEVELOPMENT (ORD) PUBLICATIONS SUMMARY
Dec. 1975 164 p
(PB-252518; EPA-600/9-75-001-d) Avail: NTIS HC $6.75 CSCL 13B

The quarterly publication provides a current listing of the Office of Research and Development's final reports on in-house, grant, contract, and interagency projects. A New Report Abstracts Section is included in the summary to provide brief abstracts of recently printed reports, as well as indexes by title, performing organization, personal author, report number, and grant, contract, or interagency agreement number to aid the reader in identifying reports of interest. GRA

N76-33730# Acurex Corp., Mountain View, Calif.
IMPACT OF CLEAN FUELS COMBUSTION ON PRIMARY PARTICULATE EMISSIONS FROM STATIONARY SOURCES Final Report, Mar. - Sep. 1975
J. Ferrell and G. Poe Mar. 1976 81 p refs
(Contract EPA-68-02-1318)
(PB-253452/7; Aerotherm-FR-75-175; EPA-600/2-76-052) Avail: NTIS HC $5.00 CSCL 07A

Coal conversion processes proposed for sulfur removal were examined to determine the implications for particulate removal requirements when the converted fuels are burned. A substantial increase in the near future is foreseen for the use of high-sulfur coal for large scale steam raising. A major reduction in SO2 emissions from those sources will be required to meet state and federal standards, either by desulfurizing the fuel or by removing SO2 from the flue gas. Based on the data obtained and the nature of the fuels, little problem is foreseen in meeting effluent requirements for particulates. The costs of sulfur removal by flue gas desulfurization (FGD) were examined briefly. The cost savings potentially obtained by elimination of effluent particulate control systems with synthetic fuels were insignificant in affecting the substantial cost advantage of FGD versus fuel conversion. GRA

N76-33731# Midwest Research Inst., Kansas City, Mo.
CONTROL TECHNOLOGY FOR ASPHALT ROOFING INDUSTRY Final Report, Apr. 1975 - Feb. 1976
Paul G. Gorman Apr. 1976 126 p refs
(Contract EPA-68-02-1324)
(PB-253415/4; EPA-600/2-76-120) Avail: NTIS HC $6.00 CSCL 07A

Results are presented of evaluations of the technical and economic feasibility of candidate control methods which may be capable of 99% removal of total hydrocarbons emitted from asphalt saturating and blowing operations in asphalt roofing plants. An industry survey showed that thermal incinerators or afterburners are currently the only techniques used to control air blowing emissions. Control techniques for saturator emissions include afterburners, wet scrubbers, high efficiency air filters and electrostatic precipitators. The efficiency of the various control techniques is discussed. GRA

N76-33732# Aeronautical Research Associates of Princeton, Inc., N.J.
TURBULENCE MODELING AND ITS APPLICATION TO ATMOSPHERIC DIFFUSION. PART 1: RECENT PROGRAM DEVELOPMENT, VERIFICATION, AND APPLICATION
W. S. Lewellen and M. Teske Dec. 1975 90 p refs
(Contract EPA-68-02-1310)
(PB-253450/1; ARAP-254-Pt-1; EPA-600/4-75-016-a) Avail: NTIS HC $5.00 CSCL 13B

Progress is described for fiscal year 1975 towards the goal of developing a viable computer model based on second-order closures of the turbulent correlation equations for predicting the fate of nonchemically reacting contaminants released in the atmospheric boundary layer. The invariant turbulent model was verified by new comparisons between model predictions and experimental observations. Model capability was extended by increasing the dimensions of the program to permit the calculation of two-dimensional, unsteady turbulent flow. A number of practical plume calculations were made and compared with standard Gaussian plume assumptions. GRA

N76-33733# ICF, Inc., Washington, D.C.
ISSUES AND IMPACTS ASSOCIATED WITH PROPOSED PREVENTION OF SIGNIFICANT DETERIORATION AND NON-ATTAINMENT AMENDMENTS TO THE CLEAN AIR ACT, EXECUTIVE SUMMARY
12 May 1976 17 p refs
(Contract FEA-CO-05-50313-01)
(PB-253438/6; FEA/G-76/283) Avail: NTIS HC $3.50 CSCL 13B

This summary outlines the major findings of recent Federal Energy Administration studies analyzing the possible effects of the proposed prevention of significant deterioration (PSD) and non-attainment amendments to the Clean Air Act. The report presenting these analyses in greater detail is being prepared. In addition, these analyses are being pursued further, and additional or refined findings will be presented at a later date. GRA

N76-33734# GCA Corp., Bedford, Mass. Technology Div.
DEVELOPMENT AND EVALUATION OF A TRANSPORTATION CONTROL PLAN FOR THE MASSACHUSETTS PORTION OF THE HARTFORD-NEW HAVEN-SPRINGFIELD AIR QUALITY CONTROL REGION. VOLUME 1: PROPOSED TRANSPORTATION CONTROL PLAN Final Report
Theodore P. Midurski, David A. Bryand, Benjamin F. Kincannon, III, Michael T. Mills, and Sharon M. Weinstein Sep. 1975 325 p refs
(Contract EPA-68-02-1376)
(PB-252697/8; GCA-TR-75-9-G-Vol-1; EPA-901/9-75-002-a) Avail: NTIS HC $9.75 CSCL 13B

The effort is an extension and modification of prior work to define the transportation control measures to attain the carbon monoxide standard in the city of Springfield. Air quality, emissions, methods for forecasting future emissions and air quality, evaluation of control measures, plan surveillance and schedules for implementation. Each alternative control measure was assessed for its social and economic impacts and associated legal and administrative issues as well as for its effectiveness at reducing pollutant emissions. A specific package of control measures is recommended. GRA

N76-33735# Harbridge House, Inc., Boston, Mass.
SOCIOECONOMIC IMPACT ASSESSMENT OF PROPOSED AIR QUALITY ATTAINMENT AND MAINTENANCE STRATEGIES Final Report
N. W. Sheldon, S. S. McKittrick, S. Siegert, C. Franz-Goldman, and K. Magnuson 4 Jun. 1976 219 p refs
(Contract EPA-68-01-1561)
(PB-253631/6; EPA-901/9-76-003) Avail: NTIS HC $7.75 CSCL 13B

As part of the State of Connecticut's Air Quality Maintenance Planning procedure, this study assesses the socioeconomic impact of three strategies for attainment and shortterm maintenance of sulfur oxide and particulate standards. The three strategies are as follows: (1) an emission limitation incorporated in the Connecticut new source review procedure; (2) an air quality impact criterion incorporated in the Connecticut new source review procedure; and (3) a proposed reduction in the allowable sulfur content of fuel burned. The analysis has included evaluation of direct and indirect costs and benefits using quantitative as well as qualitative methods. GRA

N76-33736# Midwest Research Inst., Kansas City, Mo.
SAMPLING AND ANALYSIS OF SELECTED TOXIC SUBSTANCES. TASK 1A: HEXACHLOROBENZENE Final Report, Jun. 1974 - Sep. 1975
R. T. Li, J. L. Spigarelli, and J. E. Going Jun. 1976 166 p refs
(Contract EPA-68-01-2646)
(PB-253794/2; EPA-560/6-76-001) Avail: NTIS HC $6.75 CSCL 13B

Nine industrial plants were sampled to determine hexachloroenzene (HCB) levels in air, water, soil and sediment. The plants represent six major industries: perchloroethylene, trichloroethylene, carbon tetrachloride, chlorine, triazine herbicides, and pentachloronitrobenzene. In general, higher levels of HCB were associated with the production of lower chlorinated hydrocarbons than with the production of other chemicals. HCB levels in soil and air at the pentachloronitrobenzene plant were relatively high. The levels of HCB associated with plants producting chlorine and triazine herbicides were very low. Several different waste-disposal methods were used at the perchloro- and trichloroethylene plants that were sampled. The highest level of HCB was detected in air and soil at the plant using on-site landfill and open pit storage. GRA

N76-33737# Illinois Univ., Urbana-Champaign. Water Resources Center.
BIODEGRADATION OF POLYNUCLEAR AROMATIC HYDROCARBON POLLUTANTS BY SOIL AND WATER MICROORGANISMS
Eva J. McKenna and R. D. Heath Apr. 1976 33 p refs
(Contract DI-14-31-0001-5013)
(PB-253964/1; UILU-WRC-76-0113; W76-08752; OWRT-A-073-ILL(1)) Avail: NTIS HC $4.00 CSCL 06M

The structural limits of Polynuclear Aromatic Hydrocarbons (PNA) degradability were delineated by measuring initial rates of aromatic hydrocarbon oxidation by soil and water microorganisms and the persistence of selected PNAs was determined by measuring percent remaining hydrocarbon in the presence of pure and mixed microbial cultures as a function of time and by demonstrating the appearance of metabolic products. Extensive removal of potentially carcinogenic PNAs can be effected even by the very dilute microbial suspensions found in natural waters. Since bacterial degradation of aromatic hydrocarbons does not produce a carcinogenic species, it may be that in the natural environment microbes exert a protective effect on higher organisms by continuously removing these potentially harmful chemicals from the biosphere. It is anticipated that an assessment of the biodegradability of PNAs will be of assistance to bioengineers responsible for waste management in coal conversion plants and others concerned with abatement of PNA pollution of the environment. GRA

N76-33738# Engineering-Science, Inc., McLean, Va.
SLUDGE PROCESSING, TRANSPORTATION AND DISPOSAL/RESOURCE RECOVERY: A PLANNING PERSPECTIVE
J. Michael Wyatt and Paul E. White, Jr. Dec. 1975 205 p refs
(Contract EPA-68-01-3104)
(PB-251013/9; EPA-440/9-76-002) Avail: NTIS HC $7.75 CSCL 13B

A methodology was developed for use in the evaluation of alternatives for the ultimate disposal of residual wastes generated in municipal wastewater treatment plants. This methodology considered technical, economic, social, and institutional factors pertinent to a thorough review of alternatives. Residual wastes generated in municipal wastewater treatment plants were characterized. Handling and treatment processes for the residual wastes were discussed and evaluated in light of qualitative and quantitative changes to the residual wastes. Liquid, gaseous, and solid sidestreams produced in residual waste treatment were evaluated. GRA

N76-33739# Midwest Research Inst., Kansas City, Mo.
CHEMICAL TECHNOLOGY AND ECONOMICS IN ENVIRONMENTAL PERSPECTIVES. TASK 1: TECHNICAL ALTERNATIVES TO SELECTED CHLOROFLUOROCARBON USES Final Report, Jun. 1975 - Jan. 1976
Thomas W. Lapp, G. Joe Hennon, Howard M. Gadberry, Ivan C. Smith, and Kathryn Lawrence Feb. 1976 233 p refs
(Contract EPA-68-01-3201)
(PB-251146/7; EPA-560/1-76-002) Avail: NTIS HC $8.00 CSCL 07D

The purpose of this study was to identify technically feasible substitute chemicals and/or alternative methods of delivering the goods and services presently provided through the use of the five commercial chlorofluorcarbons FC-11, -12, -13, -113, and -114. This study did not involve an assessment of the risks associated with environmental discharge of these chemicals. For the purposes of this study, recovery and/or recycling were not to be considered as eligible alternatives. Four categories currently account for 99 percent of the usage of these compounds. These areas are: refrigeration and air conditioning, aerosol propellants, plastic foam blowing agents, and cleaning and drying applications. In addition to these four areas, the Rankine Cycle engine was considered as it appears to have potential for expanding future consumption of chlorofluorocarbons. Limited evaluations were made on the direct economic consequences which could result from a reduction or elimination of chlorofluorocarbon consumption in each of the current use areas. GRA

N76-33740# Battelle Columbus Labs., Ohio.
THE TRANSPORT OF OXIDANT BEYOND URBAN AREAS Final Report
Chester W. Spicer, James L. Gemma, Darrell W. Joseph, Phillip R. Stricksel, and Gerald F. Ward Feb. 1976 224 p refs
(Contract EPA-68-02-1714)
(PB-253736/3; EPA-600/3-76-018-a) Avail: NTIS HC $7.75 CSCL 13B

Data were collected in Dayton, Ohio over a 20-day period between July 17 and August 12, 1974. Interpretations of the results are discussed in terms of statistical, graphical, chemical, and meteorological analyses of the data. The data suggest that no single source of ozone, be it urban transport, natural, emissions, stratospheric, etc. can account for the ozone patterns observed. GRA

N76-33741# Battelle Columbus Labs., Ohio.
THE TRANSPORT OF OXIDANT BEYOND URBAN AREAS, APPENDICES A-D Final Report
Chester W. Spicer, James L. Gemma, Darrell W. Joseph, Phillip R. Stricksel, and Gerald F. Ward Feb. 1976 262 p refs
(Contract EPA-68-02-1714)
(PB-253737/1; EPA-600/3-76-018-b) Avail: NTIS HC $9.00 CSCL 13B

For abstract, see N76-33740.

N76-33742# Ocean Systems, Inc., Reston, Va.
REDESIGN, FABRICATION AND TEST OF A 1000-GPM HIGH SEAS OIL RECOVERY SYSTEM AND DESIGN ONLY OF A 500-GPM HIGH SEAS OIL RECOVERY SYSTEM Final Report, Jan. 1974 - Jun. 1975
T. N. Blockwick and R. J. Smith Jun. 1975 118 p
(Contract DOT-CG-22651-A; CG Proj. 4103.11/1)
(AD-A023534; USCG-D-182-75) Avail: NTIS CSCL 13/2

This report covers the redesign, fabrication and test of a 1000-GPM high seas oil recovery system. It also discusses the design of a 500-GPM oil recovery system. This system was built primarily from the components of the 2000-GPM system. Modifications, improvements and some redesign were incorporated in this unit based on previous basin and at-sea tests. Changes were made primarily in the weir/basin and included the elimination of the trailing hoses. Limited oil collection tests in an inland tow tank and at-sea tests in the ocean were conducted using the 1000-GPM system. GRA

N76-33743# Facet Enterprises Industries, Inc., Warwick, R. I.
ACTIVATED CARBON TREATMENT OF PHENOLIC PAINT STRIPPING WASTEWATER Final Report, May 1974 - May 1975
Anthony E. Perrotti Aug. 1975 132 p refs
(Contract F08638-74-C-0005; AF Proj. 2054)
(AD-A022982; AFCEC-TR-75-14) Avail: NTIS CSCL 13/2

The use of activated carbon for removal of phenol from wastewater is a well demonstrated and generally accepted treatment method. The Air Force operates a number of facilities for the depainting of aircraft and related equipment and the wastewater generated sometimes contains high concentrations of phenol. A study was conducted to ascertain both the economical and technical practicality of using a granular carbon system for treating large volumes of this type of phenol bearing wastewater. Basically, this work involved two phases. The initial phase was performed in the laboratory and involved an in-depth characterization of the wastewater and the evaluation of different activated carbons for treating this wastewater. The

second phase was performed on-site at Kelly Air Force Base and involved operating a pilot plant for treating phenol wastewater. The carbon was exhausted five times and thermally regenerated four times. The pilot plant was operated intermittently and was on-site for a period of six months. The technical feasibility of using activated carbon on this specific wastewater was demonstrated and the cost of constructing and operating full size plants was determined. Color illustrations reproduced in black and white. GRA

N76-33744# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
STATE AIR POLLUTION IMPLEMENTATION PLAN Progress Report, 1 Jul. - 31 Dec. 1975
Apr. 1976 78 p refs
(PB-253098/8; EPA-450/2-76-006) Avail: NTIS HC $5.00 CSCL 13B

Two topics are featured: (1) the current evaluation of all State Implementation Plans (SIPs) to determine those that are substantially inadequate and need revisions to attain and maintain the National Ambient Air Quality Standards (NAAQS); and (2) an overview of carbon monoxide/oxidant control strategies with an emphasis on control of transportation related sources of these pollutants. Summaries of SIP related actions, ambient air quality trend data, and stationary source compliance information are included. GRA

N76-33745# Research Triangle Inst., Research Triangle Park, N.C.
DEVELOPMENT OF ANALYTICAL TECHNIQUES FOR MEASURING AMBIENT ATMOSPHERIC CARCINOGENIC VAPORS Final Report, Jun. 1974 - Jun. 1975
Edo D. Pellizzari EPA Nov. 1975 199 p refs
(Contract EPA-68-02-1228)
(PB-250620/2; EPA-600/2-75-076) Avail: NTIS HC $7.50 CSCL 07D

Analytical techniques and instrumentation, developed during the previous contract year, were perfected and evaluated for the collection and analysis of carcinogenic and mutagenic vapors occurring in ambient air. The areas of investigation included (a) the performance of a sorbent cartridge sampler for hazardous vapors occurring at concentrations of ng/cu m; (b) the design, fabrication, and performance of a portable field sampler; and (c) the identification of hazardous and background pollutants from several geographical areas in the continental U.S. GRA

N76-33746# Ecology Audits, Inc., Dallas, Tex.
ATMOSPHERIC EMISSIONS SURVEY OF THE SOUR GAS PROCESSING INDUSTRY Final Report
Billy J. Mullins, Jr., Dehn E. Solomon, Gary L. Austin, and Linda M. Kacmarcik Sep. 1975 135 p refs
(Contract EPA-68-02-1865)
(PB-251070/9; Rept-757-01; EPA-450/3-75-076) Avail: NTIS HC $6.00 CSCL 07A

The removal of hydrogen sulfide from natural gas was studied. The amine type processes were investigated because of their widespread use to the exclusion of other sweetening processes. Emissions from gas sweetening are the combustion products of the acid waste gases following their removal from the raw natural gas, and includes sulfur dioxide with negligible emissions of particulates, nitrogen oxides, hydrocarbons and carbon monoxide. An emission factor for SO2 was developed. SO2 emissions from gas sweetening are directly proportional to the mol percentage of H2S in the intake gas to the sweetening plant. Emissions are calculated by multiplying the whole number representing mol percent H2S by the factor 1685 to get pounds of SO2 per million cubic feet of intake gas sweetened. When the concentration of H2S is not known, a table is presented giving average H2S concentrations in gas produced in Air Quality Control Regions. GRA

N76-33747# California State Dept. of Health, Berkeley.
HEALTH AND ANNOYANCE IMPACT OF ODOR POLLUTION Final Report
John R. Goldsmith Oct. 1973 379 p refs
(Contract EPA-68-02-0083)
(PB-251169/9; EPA-650/1-75-001) Avail: NTIS HC $10.75 CSCL 06J

Health and annoyance reactions to community odor from pulp mills and other industrial sources are studied. Questionnaires were used to collect information from respondents on exposure to the odor and on health and annoyance reactions. Exposure to odor was also measured by dynamic olfactometry. The frequency with which odor was noticed and the frequency and intensity with which respondents were bothered by the odor are correlated with odor intensity and frequency as measured by dynamic olfactometry within each community. GRA

N76-33748# Science Applications, Inc., El Segundo, Calif.
HEALTH EFFECTS OF SELENIUM
D. Hausknecht and R. Ziskind Jan. 1976 44 p refs Sponsored by the Elec. Power Res. Inst.
(PB-250568/3; EPRI-571-1) Avail: NTIS HC $4.00 CSCL 06J

Selenium is found in appreciable quantities in coal and efficiently passes through the combustion process, appearing on the surface of respirable particles emitted from the stack. The inhalation health hazard is virtually unexplored and it is uncertain whether the existing airborne concentration standard for occupational exposure is being met because of inadequate monitoring capability. More stringent standards for air concentrations have been suggested in the literature, but there is an inadequate data base to support any change at this time. Measurements of the selenium airborne concentration and fallout in the vicinity of a large coal fired plant are needed to ascertain the magnitude of population dose. These data, together with information from continuing toxiological studies of selenium can clarify the potential health impact. GRA

N76-33749# Environmental Health Resource Center, Chicago, Ill.
AIRBORNE MANGANESE HEALTH EFFECTS AND RECOMMENDED STANDARD Final Report
Jul. 1975 55 p refs Sponsored by Illinois Inst. for Environ. Quality
(PB-251130/1; IIEQ-75-18) Avail: NTIS HC $4.50 CSCL 06T

The following subjects were discussed in relation to the health effects of manganese: Recommendations for further studies, rationale for the proposed ambient manganese air standard, sources and levels of manganese in the environment, absorption and retention of manganese within the body, toxicology, health effects of manganese, health effects of manganese catalytic activity in atmospheric production of sulfuric acid and sulfates, direct effects of manganese fuel additives on health, and high risk populations with respect to direct manganese toxicity. GRA

N76-33750# Sage (David), Inc., New York.
WORKBOOK FOR OPERATORS OF SMALL BOILERS AND INCINERATORS. A SELF-INSTRUCTIONAL TEXT ON THE PROPER OPERATION AND MAINTENANCE OF SMALL OIL FIRED BOILERS AND FLUE FED INCINERATORS BASED ON NEW YORK CITY CRITERIA
David Sage, Mariland Ruppart, and C. George Segelar Mar. 1976 231 p
(Contract EPA-68-02-0321)
(PB-252259/7; EPA-450/9-76-001) Avail: NTIS HC $8.00 CSCL 13B

A self-instructional workbook is provided on the proper operation and maintenance of small oil fired boilers and flue-fed incinerators. It is intended for operators in large metropolitan areas. It is designed to provide fundamentals necessary to pass the city certification examination. The learner is provided information, questions, and correct answers. The length of completion time is optional and is the choice of the student. GRA

N76-33751# National Oceanic and Atmospheric Administration, Washington, D.C. Outer Continental Shelf Task Force.
THE ENVIRONMENTAL QUALITY MONITORING REPORT
Feb. 1976 66 p
(PB-254020/1; NOAA-76041305) Avail: NTIS HC $4.50 CSCL 08J

General requirements for environmental quality monitoring are defined, including strategies, certain general methodologies,

management coordination with the program as well as with other programs, necessary research and development, and required resources. The area bounds for monitoring extend from approximately mean high water on the coast, tidal waters of estuaries, across the Continental Shelf, and over the adjacent Continental slope where pollutant transport is likely. GRA

N76-33752# Miami Univ., Fla. Sea Grant Institutional Program.
INTERNATIONAL COOPERATION FOR THE PREVENTION OF MARINE OIL POLLUTION. OCEAN AND COASTAL LAW PROGRAM
Andrew W. Anderson and William K. Bissell Sep. 1975 154 p refs
(Grant NOAA-04-5-158-14; NOAA-76041404)
(PB-253970/8; Bull-33) Avail: NTIS HC $6.75 CSCL 13B

An overview of the oil pollution problem as it existed prior to the 1976 New York Law of the Sea Conference is presented. Initial definitions are provided concerning the marine ecosystem, oil, and their interactions. International awareness of the problem and the general history of international cooperation are explained. Then the various international agreements concerning oil pollution of the marine ecosystem are discussed. Finally, developments leading up to the 1976 New York meeting are reviewed. GRA

N76-33753# Environmental Protection Agency, Washington, D.C.
REPORT ON AIRCRAFT-AIRPORT NOISE
Jul. 1973 121 p refs
(PB-253336/2) Avail: NTIS HC $5.50 CSCL 13B

The following topics were discussed: (1) adequacy of Federal Aviation Administration flight and operational noise controls; (2) adequacy of noise emission standards on new and existing aircraft; (3) recommendations on the retrofitting and phaseout of existing aircraft; (4) implications of identifying and achieving levels of cumulative noise exposure around airports; and (5) additional measures available to airport operators and local governments to control aircraft noise. GRA

N76-33754# Environmental Protection Agency, Washington, D.C.
WASTE OIL STUDY: PRELIMINARY REPORT TO THE CONGRESS
Apr. 1973 60 p refs
(PB-253332/1) Avail: NTIS HC $4.50 CSCL 13B

The problem of the disposal of waste oils and their effect on the environment was considered. Information on the quantities of waste oils produced and their physical and chemical properties was discussed. A review of the current disposal and re-refining processes was presented together with a brief evaluation of the current state-of-the-art and anticipated technological improvements. Information on the economic structure of the waste oil business was also reported. GRA

N76-33755# National Sanitation Foundation, Ann Arbor, Mich.
WATER QUALITY MONITORING IN DISTRIBUTION SYSTEMS
Robert M. Brown and K. H. Mancy May 1971 202 p refs
(PB-253328/9) Avail: NTIS HC $7.75 CSCL 13B

The overall objective of the project was to develop basic scientific criteria and specifications for a continuous monitoring system for use in the detection and control of water quality deterioration in distribution systems, and in quality control of water purification processes. Specific aims include: (1) developing new sensor systems, (2) establishing the analytical feasibility of commercially available sensors for potable water quality monitoring applications, and (3) evaluating under laboratory and field conditions the performance characteristics of each sensor in the system. GRA

N76-33756# KVB Engineering, Inc., Tustin, Calif.
FIELD TESTING: APPLICATION OF COMBUSTION MODIFICATIONS TO CONTROL POLLUTANT EMISSIONS FROM INDUSTRIAL BOILERS, PHASE 2 Final Report, Jul. 1974 - Sep. 1975
G. A. Cato, L. J. Muzio, and D. E. Shore Apr. 1976 270 p refs
(Contract EPA-68-02-1074)
(PB-253500/3; EPA-600/2-76-086-a) Avail: NTIS HC $9.00 CSCL 13B

Results are presented from testing 19 coal, oil, and gas-fired industrial boilers to determine their normal emissions and the effectiveness of combustion modifications in reducing NO(x) emissions without increasing the emission of particulates and other pollutants. Combustion modifications investigated were: reducing excess air, recirculating flue gas, staging combustion air, adjusting burner swirl registers, reducing combustion air temperature, tuning the burner, changing atomization pressure, and changing oil temperature. Emissions were found to be not significantly dependent on boiler size, but very dependent on the fuel. GRA

N76-33757# Versar, Inc., Springfield, Va.
TECHNICAL AND MICROECONOMIC ANALYSIS OF ARSENIC AND ITS COMPOUNDS
Robert P. Burruss, Jr. and Donald H. Sargent Apr. 1976 242 p refs
(Contract EPA-68-01-2926)
(PB-253980/7; Rept-454-2; EPA-560/6-76-016) Avail: NTIS HC $8.00 CSCL 13B

The role of arsenic (and its compounds) in the environment and in the economy of the United States was studied, to evaluate the need for and the projected effect of controlling its production, use, dissipation, and emission. The occurrence, chemistry, and toxicology were reviewed; the prevalence of arsenic as an impurity in commercial raw materials, processes, and products was systematically documented. The intentional commercial flow of arsenical products was quantified; the sources of pollution were identified and characterized; and the health hazards were evaluated. The intentional production and use of arsenic and its compounds is greatly exceeded by the quantities unintentionally mobilized by industrial activities. GRA

N76-33758# GCA Corp., Bedford, Mass. Technology Div.
FRACTIONAL EFFICIENCY OF A UTILITY BOILER BAGHOUSE: SUNBURY STEAM-ELECTRIC STATION Final Report, Jun. 1974 - Nov. 1975
Reed W. Cass and Robert M. Bradway Mar. 1976 244 p refs
(Contract EPA-68-02-1438)
(PB-253943/5; GCA-TR-75-17-G(4); EPA-600/2-76-077-a) Avail: NTIS HC $8.00 CSCL 07A

A fabric filter baghouse operating on the effluent of a coal-fired utility boiler was tested to determine total mass and fractional efficiencies during normal and abnormal operation with brand new and used filter bags. Total mass samplers inertial impactors, and a condensation nuclei counter were used to sample the baghouse influent and effluent. Results of the normal tests with the brand new and used bags determined the baghouse mean mass removal efficiencies to be 99.88 and 99.93%, respectively. Statistical analysis of the test results showed that the purposely altered variables had no significant effect on either the outlet concentration or penetration for normal and abnormal tests of the used bags. However, there were significant differences in the outlet concentrations and penetrations when the normal tests were compared for the new and used bags. There were also significant differences in the outlet concentrations when the new bag normal and abnormal tests were compared. GRA

N76-33759# Nuclear Regulatory Commission, Washington, D.C. Office of Management Information and Program Control.
RADIOACTIVE MATERIALS RELEASED FROM NUCLEAR POWER PLANTS, 1974 Annual Report
May 1976 119 p refs
(PB-254296/7; NUREG-0077) Avail: NTIS HC $5.50 CSCL 18H

Measured releases of radioactive materials in airborne and liquid effluents and solid waste from nuclear power plants during 1974 are summarized. The 1974 release data are compared with previous year releases in tabular form. Data covering specific isotopes are summarized. GRA

N76-33760# Rutgers Univ., New Brunswick, N.J. Dept. of Environmental Science.
GAS AND LEACHATE FROM LANDFILLS: FORMATION, COLLECTION, AND TREATMENT: PROCEEDINGS OF RESEARCH SYMPOSIUM
Emil J. Genetelli and John Cirello Mar. 1976 198 p refs

Conf. held at Rutgers Univ., New Brunswick, N. J., 25-26 Mar. 1975 Sponsored by EPA
(PB-251161/6; EPA-600/9-76-004) Avail: NTIS HC $7.50 CSCL 13B

Papers are presented dealing with solid waste management and landfill activities. Gas movement through soils, water pollution, and monitoring of toxic chemicals in landfills are among the topics discussed. Leachate recycling and treatment and solid waste degradation through shredding and sludge addition are included. J.M.S.

N76-33761# Colorado State Univ., Fort Collins.
MULTIVARIATE AND SEQUENTIAL STATISTICAL PROCEDURES IN THE BIOLOGICAL ASSESSMENT OF WATER QUALITY
Thomas J. Keefe and Eric P. Bergersen Aug. 1975 88 p refs (Contract DI-14-06-D-7550)
(PB-251173/1) Avail: NTIS HC $5.00 CSCL 13B

Graphical presentation of bivariate statistical analysis was developed and found to be ideal for the interpretation of biologically based water quality data where two responses can be measured on the same experimental unit. A technique for graphical display of R x 3 contingency tables was applied to the problem of detecting differences among aquatic communities with respect to functional biological groups and was found to be well-suited for visually inspecting such differences. Confidence interval estimation of White's measure of association between two categorical variables was developed and applied to an evaluation of fish movements in response to changing water quality. GRA

N76-33762# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
STATE IMPLEMENTATION PLAN EMISSION REGULATIONS FOR SULFUR OXIDES: FUEL COMBUSTION Final Report
J. D. Crenshaw, C. H. Kuo, and J. D. Potter Mar. 1976 82 p
(PB-251174/9; EPA-450/2-76-002) Avail: NTIS HC $5.00 CSCL 13B

State implementation plan (SIP) regulations for sulfur oxides are summarized. The relationship between the SIP regulations, the National Ambient Air Quality Standards, and the Federal Standards of Performance for New Stationary Sources is also explained, and the various types of emission regulations which appear in the SIPs are briefly analyzed. GRA

N76-33763# Environmental Sciences Research Lab., Research Triangle Park, N.C.
PHOTOCHEMICAL OXIDANTS IN THE AMBIENT AIR OF THE UNITED STATES Final Report
Basil Dimitriades Feb. 1976 188 p refs
(PB-251243/2; EPA-600/3-76-017) Avail: NTIS HC $7.50 CSCL 13B

The problem of photochemical oxidants in the ambient air of the United States is examined with respect to its nature, magnitude, and present day control. Concentration levels of ozone, nitrogen dioxide, peroxyacetyl nitrate, and other photochemically formed pollutants are surveyed, and their effects on human health, vegetation, and materials, as well as their economic impacts, are discussed. Oxidant precursors, hydrocarbons, and nitrogen oxides are reviewed with regard to ambient concentrations and emission rates and in terms of chemical reactions that produce oxidants. Oxidant control efforts are discussed with specific emphasis placed on scientific approaches, emission control methods, costs of control, and control legislation. GRA

N76-33764# Environmental Protection Agency, Washington, D.C. Office of Toxic Substances.
THE IMPACT OF INTENSIVE APPLICATION OF PESTICIDES AND FERTILIZERS ON UNDERGROUND WATER RECHARGE AREAS WHICH MAY CONTRIBUTE TO DRINKING WATER SUPPLIES. A PRELIMINARY REVIEW
David Garrett, Francis P. Maxey, and Herbert Katz 11 Dec. 1975 107 p refs
(PB-251181/4; EPA-560/3-75-006) Avail: NTIS HC $5.50 CSCL 08H

The impact of intensive application of pesticides and fertilizers on undergound water recharge areas which may contribute to drinking water supplies was assessed. A plan for developing additional information required to define the nature and extent of the impact of agricultural practices on groundwater supplies for public water systems, as required by the Safe Drinking Water Act, was also made. Nitrates, pesticides, economic impacts, and modeling and simulation were studied. Sources of groundwater pollutants were considered with a view towards determining their relative contribution to the overall problem. GRA

N76-33765# Southern Illinois Univ., Carbondale. Cooperative Wildlife Research Lab.
SOME PROPERTIES OF COAL SPOILBANK AND REFUSE MATERIALS RESULTING FROM SURFACEMINING COAL IN ILLINOIS Final Report
Ronnie J. Hynes and W. D. Klimstra Oct. 1975 138 p refs (IIEQ Proj. 20.030)
(PB-251184/8; IIEQ-75-21) Avail: NTIS HC $6.00 CSCL 08I

Land in Illinois surface mined for coal as of June 30, 1971 was surveyed. Samples of spoilbank material and refuse material were collected and analyzed. The relationships between the spoilbank material and coal seams mined, vegetation density, and age of the spoil material are evaluated. The relationships between pH of the spoilbank material and other selected chemical parameters, and the chemical properties of the refuse material (slurry and gob) are also analyzed. GRA

N76-33766# Kaman Sciences Corp., Colorado Springs, Colo.
OBJECTIVE PROCEDURES FOR OPTIMUM LOCATION OF AIR POLLUTION OBSERVATION STATIONS Final Report
C. Eugene Buell Jun. 1975 218 p refs
(Contract EPA-68-02-0699)
(PB-252622/6; EPA-650/4-75-005) Avail: NTIS HC $7.75 CSCL 13B

The development of linear regression techniques for interpolation of air pollutant concentrations over a given geographical area is considered. These techniques were used in a computer program for determining the optimum location of air pollution observing stations. The general interpolation problem was studied, and the advantages of using linear regression formulas as interpolation formulas are discussed. The case of observations containing errors of observation or effects of limited range of influence is emphasized. Since the use of linear regression methods depends on knowledge of the two-point correlation function for pollutant concentration measures, the construction of correlation coefficients from synthetic data was taken up. GRA

N76-33767# Acurex Corp., Mountain View, Calif. Aerotherm Div.
FEASIBILITY OF A HEAT AND EMISSION LOSS PREVENTION SYSTEM FOR AREA SOURCE FURNACES Final Report
R. A. Brown, C. B. Moyer, and R. J. Schreiber Apr. 1976 187 p refs
(Contract EPA-68-02-1318)
(PB-253945/0; Aerotherm-74-117; EPA-600/2-76-097) Avail: NTIS HC $7.50 CSCL 13B

Results of a brief study are given to determine the feasibility of candidate concepts for simultaneous heat and air pollutant recovery from the exhaust of domestic-size furnaces. Among the concepts investigated were improved heat exchanger design, vent dampers and heat pipes, and post-combustion emission control devices such as filters and wet scrubbers. GRA

N76-33768# Midwest Research Inst., Kansas City, Mo.
SAMPLING AND ANALYSIS OF SELECTED SUBSTANCES. TASK 1B: HEXACHLOROBUTADIENE Final Report, Jul. 1974 - Sep. 1975
R. T. Li, J. E. Going, and J. L. Spigarelli Jun. 1976 152 p refs
(Contract EPA-68-01-2646)
(PB-253941/9; EPA-560/6-76-015) Avail: NTIS HC $6.75 CSCL 07C

Environmental contamination by hexachlorobutadiene around nine chemical manufacturers was investigated. The plants selected represented six major industries: perchlorethylene, trichloroethylene, carbon tetrachloride, chlorine, triazine herbicides, and

pentachloronitrobenzene. Air, water, soil, and sediment samples were collected on and around the plants. Higher levels of HCBD in air were associated with production of perchloroethylene and trichloroethylene, while the level in the vicinity of chlorine and triazine herbicide plants was very low. No HCBD was found in the air at the pentachloronitrobenzene plant. GRA

N76-33769# North Carolina Water Resources Research Inst., Raleigh.

AVAILABILITY OF ALUMINUM PHOSPHATE FROM ALUM-TREATED WASTEWATER FOR ALGAL GROWTH

Donald E. Francisco, Brian A. Dempsey, and John C. Matheson, III May 1976 100 p refs Sponsored in part by N. C. Univ.
(Contract DI-14-31-0001-4033)
(PB-253797/5; UNC-WRRI-75-111; W76-08842; OWRT-A-075-NC(3)) Avail: NTIS HC $5.00 CSCL 13B

For phosphorus removal from wastewater, alum coagulation-precipitation is often the removal method of choice. Typically, alum is added ahead of the final settling tank in a ratio of 1.8 aluminum to 1 phosphorus. At this ratio phosphorus precipitates as an AlPO4 complex associated with coagulated Al(OH)n, species. While most 80 to 90 percent of the phosphorus is removed by settling, some carries over into the effluent. Only 10 percent of the carryover phosphorus is filterable; therefore 90 percent is in a particulate form. This research explored the availability of this particulate phosphorus in a pure chemical system, an open-channel, mixed-culture system (stream channel study), and a unialgal, batch-culture system (bioassay study). Growth of the test alga, Selenastrum capricornutum was not inhibited by Al(+3). GRA

N76-33770# Environmental Monitoring and Support Lab., Research Triangle Park, N.C. Quality Assurance Branch.

EFFECT OF TEMPERATURE ON STABILITY OF SULFUR DIOXIDE SAMPLES COLLECTED BY THE FEDERAL REFERENCE METHOD Final Report

Robert G. Fuerst, Frank P. Scaringelli, and John H. Margeson May 1976 33 p refs Sponsored by EPA
(PB-253778/5; EPA-600/4-76-024) Avail: NTIS HC $4.00 CSCL 07B

An evaluation of the effect of temperature on the stability of samples collected according to the Environmental Protection Agency procedure for measurement of ambient sulfur dioxide in the air is reported. The evaluation was carried out over the range 35 to 278 micrograms per cubic meter of air sampled. Collected samples were found to decay at a critical temperature-dependent rate. The rate of decay increases five-fold for every 10 degree centigrade increase in temperature over the range 20 to 40 degrees. The rate of decay is independent of concentrarion over the range studied, and the decay reaction follows first-order kinetics. A mathematical model was developed that allows sample decay to be calculated if the temperature history of the sample is known. GRA

N76-33771# Health Effects Research Lab., Research Triangle Park, N. C.

SCIENTIFIC AND TECHNICAL DATA BASE FOR CRITERIA AND HAZARDOUS POLLUTANTS: 1975 ERC/RTP REVIEW

May 1976 464 p refs
(PB-253942/7; EPA-600/1-76-023) Avail: NTIS HC $12.00 CSCL 13B

Hazardous pollutants are discussed, including oxides of nitrogen, carbon monoxide, hydrocarbons, photochemical oxidants, suspended particulates, sulfur oxides, asbestos, beryllium, and mercury. Adverse effects on health, vegetation, climate, visibility, and materials are assessed. Information on instrumentation, measurement, pollutant characterization, transformation and transport, and control technology for the specific pollutants is also given. GRA

N76-33772# Research Triangle Inst., Research Triangle Park, N.C.

ESTIMATION OF PERMISSIBLE CONCENTRATIONS OF POLLUTANTS FOR CONTINUOUS EXPOSURE Final Report, Jun. 1975 - Apr. 1976

Robert Handy and Anton Schindler Jun. 1976 148 p refs (Contract EPA-68-02-1325)
(PB-253959/1; EPA-600/2-76-155) Avail: NTIS HC $6.00 CSCL 06T

Results are given of a study aimed at: estimating the maximum permissible continuous exposure to which individuals may be subjected; and computing permissible exposure to a multipollutant system so that the degree of control necessary for a waste stream can be computed. The report deals with three aspects of the problem: permissible continuous exposure for air pollutants; permissible continuous exposure for water pollutants; and permissible continuous exposure to carcinogens in ambient air. Calculated permissible levels for 24 hours exposure were compared with 23 substances for which standards have been set or proposed. In general, agreement was within an order of magnitude. An appendix to the report contains a nomograph for easy estimation of maximum ground level concentrations of pollutants issuing from point sources. GRA

N76-33773# Permanent Commission and International Association of Occupational Health. Subcommittee on the Toxicology of Metals.

TOXICOLOGY OF METALS, VOLUME 1 Progress Report

Lars Friberg Mar. 1976 275 p refs Sponsored by Karolinska Inst., Stockholm and Natl. Eviron. Protect. Board, Stockholm
(Contract EPA-68-02-1287)
(PB-253991/4; EPA-600/1-76-018) Avail: NTIS HC $9.00 CSCL 06T

General principles and mechanisms of absorption and excretion of all metals, but of heavy metals in particular are presented. Accumulation and retention of toxic metals, and biological half times, particularly of cadmium, lead, and mercury are discussed. Dose-effects and dose response relationships of toxic metals, critical organs, effects and concentrations on models of retention and excretion, and homeostatic mechanisms in general are described. GRA

N76-33774# Environmental Sciences Research Lab., Research Triangle Park, N.C.

X-RAY FLUORESCENCE MULTISPECTROMETER FOR RAPID ELEMENTAL ANALYSIS OF PARTICULATE POLLUTANTS

Jack Wagman, Roy L. Bennett, and Kenneth T. Knapp Mar. 1976 43 p refs
(PB-253779/3; EPA-600/2-76-033) Avail: NTIS HC $4.00 CSCL 14B

A multichannel wavelength X ray fluorescence spectrometer, spacially adapted for rapid analysis of air pollution particulate samples, is described. The system contains an array of fixed wavelength spectrometers optimized for simultaneous analysis of 16 preselected elements and a computer operated scanning channel for the determination of any number of additional elements. A loading device permits automatic handling of batches of up to 100 frame mounted 47 mm filter samples. Instrument operation, data processing, and printout of results are controlled by a minicomputer. The system permits rapid elemental analysis at high spectral resolution. GRA

N76-33775# Midwest Research Inst., Kansas City, Mo.

COLLABORATIVE TEST OF THE CONTINUOUS COLORIMETRIC METHOD FOR MEASUREMENT OF NITROGEN DIOXIDE IN AMBIENT AIR

Paul C. Constant, Jr., Michael C. Sharp, and George W. Scheil Feb. 1975 128 p
(Contract EPA-68-02-1363)
(PB-253914/6; EPA-650/4-75-011) Avail: NTIS HC $6.00 CSCL 14B

The tentative method for the determination of nitrogen dioxide in the atmosphere (continuous colorimetric method) is examined in order to determine the precision and bias of the method. The NO2, ambient air sampling system, test site, selection of collaborators, statistical design, collaborators 'field sampling, statistical analysis of collaborators' results, conclusions and recommendations are covered. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N76-33776*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA GLOBAL ATMOSPHERIC SAMPLING PROGRAM (GASP) DATA REPORT FOR TAPE VL0003
James D. Holdeman Aug. 1976 29 p refs
(NASA-TM-X-73506) Avail: NTIS HC $4.00 CSCL 04A

Atmospheric ozone, and related flight and meteorological data for May 1975, obtained during 49 flights of a Pan American World Airways 747, are available as GASP tape VL0003 from the National Climatic Center, Asheville, North Carolina. In addition to the GASP data, tropopause pressure fields obtained from NMC archives for the dates of the GASP flights are included on the data tape. Flight routes and dates, instrumentation, data processing procedures, and data tape specifications are described. Author

N76-33777*# Maryland Univ., College Park. Meteorology Program.
INVESTIGATIONS WITH SATELLITE DATA TEMPERATURE RETRIEVALS Final Report, 15 Oct. 1975 - 1 Oct. 1976
Sigmund Fritz and Owen E. Thompson Oct. 1976 59 p refs (Grant NsG-5084)
(NASA-CR-148811; Publ-76-158) Avail: NTIS HC $4.50 CSCL 04A

A method is presented for using satellite measurements to interpolate vertical temperature soundings between radiosonde stations. The method finds a set of coefficients, which when multiplied by corresponding measured radiance quantities, yield zero temperature error at a radiosonde station. This derived set of coefficients is then applied to satellite radiance measurements at places between radiosonde stations. The computations show, for example, that the average absolute error in the layer 1000-800 mbs is only 0.3K when the corresponding 'minimum-information' method error was 2.9K. The method may be most applicable to measurements from geostationary satellites, but should also be applicable to measurements from polar orbiting satellites under certain conditions. Author

N76-33778*# Kanner (Leo) Associates, Redwood City, Calif.
TEARING INSTABILITY OF THE NEUTRAL SHEET WITH NORMAL COMPONENT OF THE MAGNETIC FIELD
A. A. Galeyev and L. M. Zelenyy Washington NASA Oct. 1976 48 p refs Transl. into ENGLISH of "Neustoychivost Neytralnogo Sloya pri Nalichii Normalnoy k Sloyu Komponenty Magnitnogo Polya" Rept. Pr-254, Moscow, Inst. of Space Res., Acad. of Sci. USSR, 1975 p 1-52
(Contract NASw-2790)
(NASA-TT-F-17225) Avail: NTIS HC $4.00 CSCL 04A

The development of tearing instability in plasma with a diffusive neutral sheet and the presence of the normal component of the magnetic field of small but finite amplitude is considered. The effect of this component at very small values, on the orbits of electrons near the neutral sheet leads to stabilization of the electron tearing mode. Development of ion tearing instability is possible only when the resonance of perturbations with ions is not disrupted and the electron Larmor orbits in the normal field do not prevent the existence of perturbations in the vicinity of the neutral sheet. It is shown that such splits can form, only if the current in the sheet is sufficiently strong. The plasma states below the instability are metastable with respect to excitation of the ion tearing mode. The results play a key part in theoretical explanation of the sharp transition to the explosive phase of magnetosphere substorms. Author

N76-33779*# Kanner (Leo) Associates, Annapolis, Md.
CERTAIN ACTUAL PROBLEMS IN THE THERMAL SOUNDING FROM A SATELLITE
V. A. Golovko Washington NASA Oct. 1976 92 p refs Transl. into ENGLISH of "Nekotoryye Aktualnyye Voprosy Termicheskogo Zondirovaniya s ISZ" Moscow, Acad. of Sci. USSR, report, 1976 p 1-108
(Contract NASw-2790)
(NASA-TT-F-17252) Avail: NTIS HC $5.00 CSCL 04A

The current state of the problem of thermal sounding of the atmosphere from satellites is described. The numerical solution of the reverse problem is discussed within the framework of the statistical approach. Other topics discussed include optimization of conditions of spectroradiometric measurements, problems of the stability of the solution of the reverse problem, investigation of the characteristics of carbon dioxide gas absorption and practical methods of measurement of the spectrum and processing of spectral information allowing restoration of the three-dimensional field of temperature on a global scale. Author

N76-33780*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DETERMINATION OF THE COSMOLOGICAL RATE OF CHANGE OF G AND THE TIDAL ACCELERATIONS OF EARTH AND MOON FROM ANCIENT AND MODERN ASTRONOMICAL DATA
Paul M. Muller 15 Sep. 1976 29 p refs
(Contract NAS7-100)
(NASA-CR-148994; JPL-SP-43-36) Avail: NTIS HC $4.00 CSCL 08E

The theory and numerical analysis of ancient astronomical observations (1374 to 1715) are combined with modern data in a simultaneous solution for: the tidal acceleration of the lunar longitude; the observed apparent acceleration of the earth's rotation; the true nontidal geophysical part of this acceleration; and the rate of change in the gravitational constant. Provided are three independent determinations of a rate of change of G consistent with the Hubble Constant and a near zero nontidal rotational acceleration of the earth. The tidal accelerations are shown to have remained constant during the historical period within uncertainties. Ancient and modern solar system data, and extragalactic observations provided a completely consistent astronomical and cosmological scheme. Author

N76-33781# Institute of Geological Sciences, London (England).
ESKDALEMUIR, HARTLAND AND LERWICK OBSERVATORIES. MAGNETIC RESULTS 1971
1975 103 p
(Geomagnetic-Bull-5; ISBN-0-11-880767-6) Avail: NTIS HC $5.50; HMSO £4.50; PHI

Magnetic results from the observatories at Eskdalemuir, Hartland and Lerwick for 1971 are presented. Tables include hourly values of declaration west, horizontal and vertical intensity, K-indices and diurnal inequalities. ESA

N76-33782# Institute of Geological Sciences, London (England).
ANNUAL MEAN VALUES OF GEOMAGNETIC ELEMENTS SINCE 1941
Marion P. Fisher 1976 172 p
(Geomagnetic-Bull-6; ISBN-0-11-880768-4) Avail: NTIS HC $6.75; HMSO £7; PHI

Magnetic observatories are listed together with their geographic and geometric coordinates, height above mean sea level and years of operation. Annual means of D, H, I, X, Y, Z, T from 1941 are tabulated for each. ESA

N76-33783# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
ON THE EARTH'S BOW SHOCK MOTION AND SPEED
V. Formisano and G. Mastrantonio Aug. 1974 14 p refs
(LPS-74-22) Avail: NTIS HC $3.50

The importance of tangential discontinuities for the earth bow shock motion and speed was verified using HEOS-1 plasma data. An average of 12.6 discontinuities per day were observed in the solar wind. The analysis of the satellite data indicated that tangential discontinuities may indeed be the most important cause of the bow shock motion and speed. In the solar wind there are sufficient large tangential discontinuities to explain, according to the Voelk and Auer theory, the large observed average shock speeds. ESA

N76-33784# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
ANALYSIS OF DATA ON XUV RADIATION IN THE PLASMASPHERE OBTAINED BY AN EQUATORIAL ROCKET

DURING THE ECLIPSE OF 30 JUNE 1973 [ANALISI DEI DATI SULLA RADIAZIONE XUV DELLA PLASMASFERA OTTENUTI MEDIANTE RAZZO EQUATORIALE DURANTE L'ECLISSE DEL 30 GIUGNO 1973]

A. Blanco, R. Habel, and G. Pizzella Oct. 1974 25 p refs In ITALIAN

(LPS-74-24) Avail: NTIS HC $3.50

A method to extract useful data from the raw data obtained from a Nike-Tomahawk sounding rocket on the occasion of a solar eclipse is presented. Due to a malfunction, the counting in the channeltron spuriously increased. The results on e.m. radiation from the earth plasmasphere at values of 304, 584, 820, 920, 1026, and 1216 A are given in graphical form. ESA

N76-33785# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

SIGNAL ANALYSIS OF A GRAVITATIONAL ANTENNA WITH NON-TUNING DETECTOR [ANALISI DEL SEGNALE DI UNA ANTENNA GRAVITAZIONALE CON RIVELATORE NON RISONANTE]

F. Palutan Dec. 1974 84 p refs In ITALIAN

(LPS-74-33) Avail: NTIS HC $5.00

The properties of signals from a gravitational wave cylindrical antenna are discussed using a mathematical model which is detailed. The model, based on the assumption that the gravitational wave signal is a transient and that the antenna output thermal noise is a stationary process with normal distribution in a limited band, entails some specifications for data acquisition; these are described. The response of the quadrature receiver to the thermal noise of the antenna and the wide band noise from the electronics was calculated. ESA

N76-33786# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

ATMOSPHERIC TRANSPARENCE MEASUREMENT IN THE MEDIUM INFRARED [MISURE DI TRASPARENZA ATMOSFERICA NEL MEDIO INFRAROSSO]

V. Pericoli and P. Saraceno Apr. 1975 37 p refs In ITALIAN

(LPS-75-10) Avail: NTIS HC $4.00

The atmospheric transparence over Frascati in the near and medium infrared range (from 2 to 20 microns) was measured in order to determine the limits of astronomical measurements carried out from the ground in this range of spectrum and to improve the knowledge of the seasonal variation of atmospheric transparence. The experimental equipment is described and the experimental data discussed. ESA

N76-33787# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

THE MAGNETOPAUSE. PART 1: MULTISATELLITE SIMULTANEOUS OBSERVATIONS OF BOW SHOCK AND MAGNETOPAUSE POSITIONS

V. Formisano Aug. 1975 14 p refs

(LPS-75-23-Pt-1) Avail: NTIS HC $3.50

Simultaneous multisatellite observations of the earth's bow shock and magnetopause positions were made in order to calculate gamma, the solar wind specific heat ratio. The satellites used were OGO-5 and HEOS-1. On six occasions OGO-5 crossed the bow shock and HEOS-1 observed the magnetopause; in seven cases the opposite occurred. The measured values of the gamma range from 1.36 to 2.05, with some indication that low values relate to low frequency (0.05 Hz) upstream waves, whereas high values were obtained when no upstream waves were observed. The average value is exactly 1.666. In the laminar magnetosheath cases very high gamma values were obtained. ESA

N76-33788# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

THE MAGNETOPAUSE. PART 2: MAGNETOPAUSE POSITION AND THE RECONNECTION PROBLEM

V. Formisano Aug. 1975 31 p refs

(LPS-75-24-Pt-2) Avail: NTIS HC $4.00

OGO-5 magnetic field data were used to locate the magnetopause, while HEOS-1 (or sometimes Explorer 33) plasma data were used to measure the solar wind dynamic pressure and to study the actual response of the magnetosphere (through the location of the magnetopause) to different solar wind pressures. The OGO-5 magnetopause positions were divided into two groups, one relating to observations close to the ecliptic plane, the other having a sun-earth-satellite angle greater than 56.5 deg. Results show that not only is the interplanetary magnetic field latitude important for the magnetopause position (and therefore for the reconnection process) but also the presence or absence of magnetosheath turbulence and the proton number density are important. ESA

N76-33789# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

THE MAGNETOPAUSE. PART 3: CLASSIFICATION OF MAGNETOPAUSE STRUCTURES

V. Formisano and P. C. Hedgecock (Imperial Coll. of Sci. and Technol.) Aug. 1975 35 p refs

(LPS-75-25) Avail: NTIS HC $4.00

Studying HEOS-1 magnetopause crossing and using solar wind magnetic field data from Explorer 33 and 35, a list of observed magnetopause structures was made: non-reconnected, smooth, inverse, reconnecting close to the diffusion region, reconnecting away from the diffusion region, and Petscheck magnetopause. These structures are discussed in detail. The magnetopause structure was found to be a function of the position in space (2 parameters), of Chi (1 parameter?) defining the model according to which the reconnection will occur, and of the reconnection speed. ESA

N76-33790# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

BROWNIAN NOISE MEASUREMENTS FOR A GRAVITATIONAL ANTENNA

F. Bordoni, G. V. Pallottino, and G. Pizzella Sep. 1975 22 p refs

(LPS-75-28) Avail: NTIS HC $3.50

A small size gravitational wave antennna cooled to liquid helium temperatures, which has a sensitivity which should be comparable to that of the larger Weber-type antennas operating at room temperature is under construction in Rome. The purpose of such an instrument is to test the techniques to be used for a 5-ton aluminum bar antenna and to obtain gravitational wave data with an instrument different, in various aspects, from those used by several groups up to the present time. The antenna consists of a 10.4 kg aluminum cylindrical bar, 20 cm long, suspended by a steel wire in a cryostat at a minimum temperature of 1 K. The vibrations are detected by means of a Gulton lead zirconate titanate G-1408 piezoelectric ceramic. Two smaller ceramics, Vernitron BSG1-6, are used for sending calibration pulses and for measuring the antenna resonance frequency. Author (ESA)

N76-33791# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

ONE-DIMENSIONAL COMPUTER SIMULATION OF A GRAVITATIONAL ANTENNA: PRELIMINARY RESULTS

G. V. Pallottino Sep. 1975 80 p refs

(LPS-75-30) Avail: NTIS HC $5.00

The simulation is based on a one-dimensional model, the physical basis of which is related to the representation of the antenna as a distributed rather than as a concentrated model. The two sensor correlation technique was analyzed and successfully applied to the detection of long duration GW imbedded in Brownian noise. Other techniques are presented, such as a distance algorithm in the signal space that appears to be very promising for the detection of short pulses of GW. Author (ESA)

N76-33792# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

NOTES ON THE ELECTRODYNAMICS OF A MOVING CONDUCTING WIRE IN THE IONOSPHERIC PLASMA

M. B. Bavassano-Cattaneo and M. Dobrowolny Sep. 1975 27 p refs

(LPS-75-31) Avail: NTIS HC $4.00

A study of the electrodynamic properties of the recently proposed Sky-Hook device was initiated. Sky-Hook is a long wire (appr. 100 km) which can be transported, in a more or less vertical position, by Spacelab around the earth. It is indicated as a probably unique tool for various types of scientific research

from Spacelab, for atmospheric science experiments, magnetospheric and radio physics experiments, and measurements of the gravity field of the earth at high resolution. A brief review of relevant plasma parameters (typical lengths and frequencies, conductivities, etc.) and their variations between 100 and 700 km, is given. An order of magnitude evaluation of the current in the passive wire (or rather its upper limit) and of the corresponding powers in the wire and in the plasma are presented. Sheath effects between the wire and the plasma are taken into account. Author (ESA)

N76-33793# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
THE OUTER MAGNETOSPHERE. PART 1: A MULTISATELLITE STUDY OF THE MAGNETOPAUSE POSITION IN RELATION WITH SOME IMPORTANT FLUID DYNAMIC PARAMETERS
V. Formisano Feb. 1976 32 p refs
(LPS-76-2-Pt-1) Avail: NTIS HC $4.00

Simultaneous observations by OGO-5 and HEOS-1 of the magnetopause and the earth's bow shock give a measurement of the magnetosheath thickness, allowing a determination of the magnetosheath specific heats ratio. A statistical study of the magnetopause position, normalized with respect to the solar wind dynamical pressure, allows the determination of f2/K and, in a few cases, of f and K separately. The quantity f2/K varies over a large range and, on average, has the value f2/K = 1.55. The geomagnetic field compression factor f has the value f = 1.53, while the stagnation pressure factor K is K approximately = 2.9, a value much larger than predicted, probably because of the presence of the magnetic field in the solar wind, and, possibly, of erosion of the day-side magnetosphere. Both the fluid dynamic approach and the current sheet model of the solar wind confinement of the earth magnetic field appear to be insufficient. Author (ESA)

N76-33794# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
THE OUTER MAGNETOSPHERE. PART 2: IDENTIFICATION OF MAGNETOPAUSE STRUCTURES
V. Formisano and P. C. Hedgecock (Imperial Coll. of Sci. and Technol.) Feb. 1976 32 p refs
(LPS-76-3-Pt-2) Avail: NTIS HC $4.00

Combined plasma and magnetic field measurements recorded by the HEOS-1 satellite during 70 magnetopause crossings at 20 to 50 deg magnetospheric latitude are described. These reveal several different types of local magnetopause structure; an example of each is presented. The considerable variety of structure and the observation that certain types of structure are found only in particular spatial regions is interpreted as indicating that the magnetopause structure varies with position on the boundary surface at any one time according to the local field geometry. Details of the structure, revealed in relatively low time resolution data, suggest that it is imperative to consider both field and plasma measurements in defining the position of the magnetopause. Author (ESA)

N76-33795# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
THE OUTER MAGNETOSPHERE. PART 3: SIMULTANEOUS MULTISATELLITE OBSERVATIONS OF THE MAGNETOPAUSE. DIFFERENCES BETWEEN LOCAL STRUCTURES
V. Formisano Mar. 1976 29 p refs
(LPS-76-4-Pt-2) Avail: NTIS HC $4.00

Simultaneous observations of magnetopause structure with HEOS-1 and OGO-5 (Day 341, 350 1969) or Explorer 35 (Day 300, 1969) are studied. It is shown that the magnetopause structure is similar over a large portion of space if similar conditions are present. In one case (Day 350, 1969) the structure observed at HEOS-1 (reconnected magnetopause close to the diffusion zone) is very different from the two discontinuity structure observed at OGO-5 (reconnected magnetopause away from the diffusion zone). At HEOS-1 the magnetic field intensity appears to be enhanced on both sides of the magnetopause, by at least 10 gammas, compared with ambient field intensity. The magnetospheric magnetic field (at about 95 deg to the magnetosheath magnetic field) appears to be distorted, with respect to the meridian plane, in the opposite sense compared with the magnetospheric models. Author (ESA)

N76-33796# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
THE OUTER MAGNETOSPHERE. PART 4: CONSEQUENCES OF MAGNETIC MERGING AT THE MAGNETOPAUSE
V. Formisano Feb. 1976 42 p refs
(LPS-76-5-Pt-4) Avail: NTIS HC $4.00

Two possible consequences of magnetic merging are studied: first, the presence of ionospheric-magnetospheric currents in the outer magnetosphere, as consequence of magnetospheric convection; second, the presence of magnetosheath-like plasma, possibly penetrating through the magnetopause. The field aligned currents were studied through the effect they have on the field direction projected in the equatorial plane. In 25% of the magnetopause crossings the magnetospheric lines of force show an anomalous distortion (sunward instead of tailward of the meridian planes) related, most likely, to the field aligned currents. This anomalous distortion is preferentially present at middle latitudes in the day side region. Another important feature of the outer magnetosphere was found in the magnetic field intensity as an abrupt increase of B (going earthward it appears as an abrupt decrease) usually located 1 to 2 earth radii from the magnetopause. This feature was observed 40% of the time at any latitude or local time. Magnetospheric plasma was observed in at least 8 magnetopause crossings. Bulk speed and density appear to be lower in the magnetosphere, the temperature being higher there than in the magnetosheath. Author (ESA)

N76-33797# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
THE OUTER MAGNETOSPHERE. PART 5: PLASMA PENETRATION IN THE MAGNETOSPHERE
M. B. Bavassano-Cattaneo, V. Formisano, and P. C. Hedgecock (Imperial Coll. of Sci. and Technol.) Feb. 1976 49 p refs
(LPS-76-6-Pt-5) Avail: NTIS HC $4.00

Plasma penetration into the magnetosphere has been observed by the LPS plasma experiment onboard HEOS-2 satellite. Three magnetospheric plasma regions were distinguished, namely, the entry layer, the cusp-stagnation region, and the plasma mantle. A possible interpretation of the observations is that plasma may penetrate in the magnetosphere, apart from the cusps, also from the entry layer through a mechanism yet unknown. The observed thinning of the plasma mantle at large tailward distances is interpreted as a density decrease, consequence of field lines tailward motion. The three regions identified are all topologically connected and this induces the belief that all magnetospheric plasma has a common origin, namely the magnetosheath.
Author (ESA)

N76-33798# Systems Science and Software, La Jolla, Calif.
IMPROVED YIELD DETERMINATION AND EVENT IDENTIFICATION RESEARCH Quarterly Technical Report, 1 Aug. - 31 Oct. 1975
J. M. Savino, T. C. Bache, T. G. Barker, J. T. Cherry, and W. O. Wray 17 Nov. 1975 47 p refs
(Contract F08606-75-C-0045; ARPA Order 2551)
(AD-A022210; SSS-R-76-2788) Avail: NTIS CSCL 19/4

Teleseismic ground motion predictions for the recent Pahute Mesa explosion, MAST, were quite successful in terms of both amplitude and waveform matching. The predicted short-period body wave amplitudes were within 30 to 50 percent of the observed amplitudes at most of the SDCS stations. In addition, the general character of the first few seconds of the P-wave trains at the various SDCS stations were matched in reasonable detail. A tension failure model that describes the development of a region of enhanced tension failure (cracking) produced during stress release behind the interacting shock fronts from closely spaced explosions was developed. Calculations for a multiple explosion scenario (three closely spaced explosions detonated simultaneously) were carried out into the elastic region using the two-dimensional CRAM code with the new material failure model included. GRA

N76-33799# Aeronautical Research Associates of Princeton, Inc., N.J.

TURBULENCE MODELING AND ITS APPLICATION TO ATMOSPHERIC DIFFUSION. PART 2: CRITICAL REVIEW OF THE USE OF INVARIANT MODELING

W. S. Lewellen and M. Teske Dec. 1975 59 p refs
(Contract EPA-68-02-1310)
(PB-253451/9; ARAP-254-Pt-2; EPA-600/4-75-016-b) Avail: NTIS HC $4.50 CSCL 04A

A method for the calculation of turbulent shear flows based on closure of the equations for second-order correlations of fluctuating quantities is reviewed. Various model possibilities for closure are described, and coefficients for a simple model are evaluated. Model predictions and experimental data for a wide variety of laboratory and atmospheric flows are compared. GRA

N76-33800# National Geodetic Survey, Rockville, Md.

ADJUSTMENT OF GEODETIC FIELD DATA USING A SEQUENTIAL METHOD

Marvin C. Whiting and Allen J. Pope Mar. 1976 17 p refs
(PB-253967/4; NOAA-TM-NOS-NGS-3; NOAA-76041401) Avail: NTIS HC $3.50 CSCL 08E

Using remote terminals, National Geodetic Survey field parties are now able to carry out limited adjustments for the purpose of evaluating their observations. Such an adjustment must be able to handle incomplete networks. The method adopted was developed by Creusen (1965). It is a sequential adjustment using a modified arithmetic which automatically handles all problems of possible singularities, giving for indeterminate parameters their pseudoinverse solution accompanied by appropriate flags. GRA

N76-33801# Center for the Environment and Man, Inc., Hartford, Conn.

EXAMINATION OF SOME SOLAR RADIATION RECORDS FROM THE MAUNA LOA OBSERVATORY Final Report

G. D. Robinson Feb. 1976 37 p refs
(Grant NOAA-03-5-022-79)
(PB-253201/8; CEM-4189-543; NOAA-76031505) Avail: NTIS HC $4.00 CSCL 04A

Measurements of solar radiation made at Mauna Loa Observatory were examined, particularly in the context of their use in monitoring the atmospheric particle burden. The two main concerns were: (1) internal consistency in the spectral detail of the measurements of both the absorptive and the scattering attenuation of solar radiation by atmospheric particles and (2) the solar constant and its spectral detail. GRA

N76-33802# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.

REVIEW OF IONOSPHERIC SMALL SCALE STRUCTURE WITH EMPHASIS ON EQUATORIAL RADIO SCINTILLATION IN THE SHF BAND

Joseph H. Pope and Clifford Rufenbach Sep. 1975 29 p refs
(PB-253054/1; NOAA-TR-ERL-343; SEL-34; NOAA-76032204) Avail: NTIS HC $4.00 CSCL 04A

The literature relating to small scale ionospheric irregularities in electron density observed by in-situ and scintillation methods is examined for possible causes of the high level scintillation activity observed in the equatorial regions in the SHF band. A global scintillation model is extrapolated from the VHF to SHF regions by incorporating the power law irregularity spectrum into existing scintillation theory. Other studies reported include a theoretical explanation of an interference pattern observed as a ringing on radio beacon records of signals from ATS-6. GRA

N76-33803# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.

QUANTITATIVE EVALUATION OF ACOUSTIC ECHOES FROM THE PLANETARY BOUNDARY LAYER

William D. Neff Jun. 1975 39 p refs
(PB-253207/5; NOAA-TR-ERL-322; WPL-38; NOAA-76032202) Avail: NTIS HC $4.00 CSCL 04A

Using two acoustic echosounders, one of which operated at simultaneous wavelengths of 0.12, 0.15, and 0.19 m, the acoustic backscatter cross section was obtained as a function of time and height in the planetary boundary layer. The cross sections were interpreted in terms of the temperature structure parameter alpha and compared with values obtained in situ at the 92 m level on a tower located some 300 m distant. Excellent agreement was found between the two sets of alpha values under statically unstable conditions. GRA

N76-33804# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Data Service.

UNITED STATES EARTHQUAKES, 1973 Joint Annual Report

Jerry L. Coffman, Carl A. VonHake, William Spence (Geol. Surv., Reston, Va.), David L. Carver (Geol. Surv., Reston, Va.), Pamela A. Covington (Geol. Surv., Reston, Va.), Gerald J. Dunphy (Geol. Surv., Reston, Va.), W. LeRoy Irby (Geol. Surv., Reston, Va.), Waverly J. Person (Geol. Surv., Reston, Va.), and Carl W. Stover (Geol. Surv., Reston, Va.) 1975 118 p refs
(PB-250362/1; NOAA-76020903) Avail: NTIS HC $5.50 CSCL 08K

All earthquakes that were felt in the United States and nearby territories during 1973 are described. Earthquakes are listed chronologically in 11 regions: Northeastern Region, Eastern Region, Central Region, Western Mountain Region, California and Western Nevada, Washington and Oregon, Alaska, Hawaii, Panama Canal Zone, Puerto Rico, and Virgin Islands. In addition, instrumental epicenters of U.S earthquakes and principal earthquakes of the world are listed. Selections on horizontal and vertical control surveys for crustal movement studies, tsunamis, well-water fluctuations, and strong-motion seismograph data are included. GRA

N76-33805# National Center for Atmospheric Research, Boulder, Colo.

THE STRATOSPHERE AND MESOSPHERE: DYNAMICS, PHYSICS, AND CHEMISTRY. VOLUME 2: SATELLITE WORKSHOP

John C. Gille 1975 165 p refs
(Contract NSF C-760)
(PB-253374/3; NCAR/CQ-4-1975-ASP-Vol-2) Avail: NTIS HC $6.75 CSCL 04A

A nine-week colloquium involving a selection of scientists and graduate students was held at the National Center for Atmospheric Research in an attempt to assess the present status of research on the stratosphere and mesosphere and foresee future trends. The colloquium consisted of daily lectures by invited speakers who each participated for two weeks, afternoon seminars by vistors, and a workshop on the use of satellites in ths study of the upper atmosphere. Roughly four categories of stratospheric and mesospheric research were discussed: dynamics, chemistry, radiative transfer, and social impacts. GRA

N76-33806# Teledyne Geotechnical, Alexandria, Va. Seismic Data Analysis Center.

APPLICATION OF THE ITERATIVE BEAM PROCESSOR TO LONG-PERIOD RAYLEIGH WAVES

Theodore J. Cohen, Zoltan A. Der, and John Lambert 7 Oct. 1975 30 p refs
(Contract F08606-76-C-0004; ARPA Order 2551; ARPA Order 1620; VT Proj. 6709)
(AD-A023236; SDAC-TR-75-8) Avail: NTIS CSCL 17/10

The effectiveness of the iterative beaming technique for the separation of superposed Rayleigh wave signals was evaluated. This technique can be useful for the detection and discrimination of seismic events the signals of which arrive simultaneously at a seismic array. The technique was applied to superposed recordings of Rayleigh waves at LASA. It was found the multipathing of Rayleigh waves can cause enough leakage into the beam of the desired event to make the separation impossible if the amplitude of waves from the event to be eliminated is more than three times that of the event of interest. GRA

N76-33807# Aeronutronic Ford Corp., Billings, Mont. Aero-Comm Engineering Services Div.

MONTANA LARGE APERTURE SEISMIC ARRAY Semiannual Technical Report, 1 Jul. - 31 Dec. 1975

Robert E. Matkins 23 Jan. 1976 89 p refs
(Contract F08606-76-C-0005; Proj. VELA)
(AD-A023263; TR-2126-76-75; SATR-1) Avail: NTIS CSCL 17/10

The continued operation, maintenance, and array improvement activities at the Montana LASA during the reporting period are described. Array operations including the preparation of daily

teleseismic event reports during the system conversion at the Seismic Data Analysis Center are detailed. Teleseismic processing methods are indicated. Neat regional event detection and reporting are summarized. SP and LP seismograph system performance measurements are presented. New PDP-7 computer programs for playout and recording of array data are described. Maintenance activities at both the data and maintenance centers are discussed. GRA

N76-33808# Tetra Tech, Inc., Pasadena, Calif.
WAVES GENERATED BY HORIZONTAL OSCILLATIONS Final Report
Y. Keen Lee and Li-San Hwang Jun. 1975 74 p
(Grant NSF GI-38982)
(PB-252457/7; NSF/RA/E-75-122) Avail: NTIS HC $4.50 CSCL 08K

An analytical description of earthquake generated waves in protected artificial basins is presented. Linearized, inviscid, irrotational surface gravity wave theory is applied to basins of uniform depth with vertical boundaries. Numerical solutions are presented for closed rectangular and circular basins and open rectangular basins. A computer program listing and a program user's guide are included. GRA

N76-33809# Naval Research Lab., Washington, D.C.
ULTRAVIOLET SPECTRAL RADIANCE OF THE HORIZON SKY Final Report
G. L. Knestrick and J. A. Curcio Mar. 1976 18 p refs
(NRL Proj. R05-31C)
(AD-A024226; NRL-MR-3246) Avail: NTIS CSCL 17/5

Representative data are presented concerning the spectral radiance of the horizon sky for wavelengths between 300 and 420 nm at three observation azimuths at different times of the day under various meteorological conditions. The measurements were made over water at the Chesapeake Bay. The radiance values were usually between 3 and 8 microW/sq cm sr nm in the 350-400 nm region during the middle of the day.
Author (GRA)

N76-33810# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
GEODETIC APPLICATIONS OF MULTIQUADRIC EQUATIONS Final Report
Rolland L. Hardy May 1976 92 p refs
(Grant NSF GK-40287)
(PB-255296/6; ISU-ERI-AMES-76245) Avail: NTIS HC $5.00 CSCL 08E

It is shown that geodetic applications of multiquadric functions in harmonic form are quite closely related to functional methods associated with point mass anomalies. Multiquadric equations are used in a least squares prediction method which is conceptually different than least squares prediction using covariance functions. In comparative tests the multiquadric method was found to be superior to the covariance method in applications involving topography and gravity anomalies. GRA

N76-33811# Minnesota Univ., Minneapolis. Div. of Science and Mathematics.
IONOSPHERIC CHEMISTRY: COMPARISON OF AIRCHEM PREDICTIONS WITH RESULTS OF LABORATORY SIMULATIONS Final Report
Merle N. Hirsh 30 Dec. 1975 25 p refs
(Grant DAHC04-74-G-0045)
(AD-A024146; ARO-12145.1-RTL) Avail: NTIS CSCL 04/1

The AIRCHEM code has been used to calculate the time evolution of ionic and neutral species during a1,000 -second bombardment of airlike N2:O2 mixtures at p=2 and 5 Torr and 300K by 1-MeV electrons. To test the sensitivity of the predictions to assumptions regarding the production rates of specific atomic and molecular ionic and metastable species in collisions of energetic electrons with N2 and O2 molecules, three sets of rates currently used by aeronomists were employed. Ion spectra obtained in the laboratory during electron bombardment of airlike N2O2 mixtures containing traces of H2O and CO2, at 2 and 5 Torr, were compared with the predictions based on AIRCHEM. Many features of the ion spectra agree with theory. Thus, the general ionic composition of the laboratory plasma was as expected. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N76-33812*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COMPENDIUM OF METEOROLOGICAL DATA FOR THE ATS-F LAUNCH IN MAY 1974
J. Briscoe Stephens, S. I. Adelfang (Science Applications, Inc., Huntsville, Ala.), and A. I. Goldford (Science Applications, Inc., Huntsville, Ala.) Aug. 1976 36 p ref
(NASA-TM-X-73336) Avail: NTIS HC $4.00 CSCL 04B

All the meteorological data for the 32-hour period before the ATS-F launch from Kennedy Space Center at 0900 EDT on May 30, 1974, are archived at the Marshall Space Flight Center. These data were collected in support of the NASA rocket exhaust effluent prediction and monitoring program. This data set is unique in that soundings were made hourly from T-12 to T-0 hours, providing high temporal resolution. All supporting data, such as synoptic charts and surface data, are also included. This is the third in a series of seven data reports. Author

N76-33813*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COMPENDIUM OF METEOROLOGICAL DATA FOR THE CENTAUR LAUNCH IN FEBRUARY 1974
J. Briscoe Stephens, S. I. Adelfang (Science Applications, Inc., Huntsville, Ala.), and A. I. Goldford Aug. 1976 36 p ref
(NASA-TM-X-73335) Avail: NTIS HC $4.00 CSCL 04B

The meteorological data for the 33-hour period prior to the Centaur (Titan III E) launch from Kennedy Space Center at 0948 EDT on February 11, 1974, are archived in this report. These data were collected in support of the NASA rocket exhaust effluent prediction and monitoring program. This is a rather unique data set in that a high temporal resolution of upper air soundings is provided. All supporting data, such as synoptic charts and wind tower data, are also included. This is the second in a series of seven data reports. Author

N76-33814# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A CONCEPT AND PLAN FOR THE DEVELOPMENT OF A WEATHER SUPPORT SUBSYSTEM FOR AIR TRAFFIC CONTROL
Steven I. Krich and Steven M. Sussman 16 Apr. 1976 123 p refs
(Contracts DOT-FA74WAI-485; F19628-76-C-0002)
(AD-A028296/2; ATC-64; FAA-RD-76-23) Avail: NTIS HC $5.50 CSCL 17/7

The primary needs of air traffic controllers, flow controllers, and central flow controllers for weather information were investigated. A cost effective system concept to meet these needs was defined, and a plan for the development of the proposed weather subsystem to support Air Traffic Control was devised. The recommended system will provide rapid generation and dissemination of reliable user oriented observations and very short range severe weather forecasts (up to 30 min.) to facilitate controller planning. This new capability will: (1) reduce weather induced controller work load peaks; (2) permit controllers to coordinate and preplan aircraft rerouting for weather avoidance; (3) achieve an improved balance between the inefficiency of overreaction and the essentials of safety; (4) facilitate controller response to pilot requests for weather data on a work load permitting basis; and (5) enable the issuance of accurate weather advisories. The system will also provide rapid generation and dissemination of reliable short range forecasts (up to 4 hours) to permit early introduction of necessary flow control procedures. This new capability will decrease problems for controller, increase acceptance of flow control, and increase traffic flow efficiency without decreasing safety. Author

N76-33815*# Scientific Translation Service, Santa Barbara, Calif.
RADIO NAVIGATION (OMEGA) SIGNALS FOR WIND MEASUREMENT
B. Loitiere and C. Brosson Washington NASA Sep. 1976 18 p Transl. into ENGLISH from Meteorologie (Paris), 1975 p 71-78

(Contract NASw-2791)
(NASA-TT-F-17210) Avail: NTIS HC $3.50 CSCL 04B

Several Omega stations beam signals at a moving airborne receiver (balloon) which receives them, and retransmits them at HF to a ground station. The location of the balloon is determined on the basis of the phase shifts of the signals transmitted by the Omega stations. The information about balloon position can be used to determine wind direction and velocity by means of a numerical data reduction technique using a Kalman filter. Of particular importance is the elimination of erroneous phase shifts which are due to system malfunction or signal fading. Author

N76-33816*# Kanner (Leo) Associates, Redwood City, Calif.
ESTIMATING WINTERING CONDITIONS FOR WINTER CROPS IN THE SOUTHEAST EUROPEAN USSR
Moiseychik Washington NASA Sep. 1976 35 p refs Transl. into ENGLISH from Tr. Tsentr. Inst. Prognozov (USSR), v. 41, issue 68, 1955 p 3-20
(Contract NASw-2790)
(NASA-TT-F-17218) Avail: NTIS HC $4.00 CSCL 04B

Since winterkill dominates in causes of crop losses in the southeast European U.S.S.R., studies were conducted over several seasons relating air temperature, snow cover, and soil temperature (3 cm below surface, tillering node depth). The goal was to find which combinations of conditions ensure viable 3 cm, tillering node soil temperatures for the survival of winter cereal crops. The duration of cold spells was also allowed for in estimating wintering conditions for winter crops in this region. Author

N76-33817*# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
STUDIES OF EARTH SIMULATION EXPERIMENTS
John E. Hart Washington NASA Oct. 1976 73 p refs
(Contract NAS8-31149)
(NASA-CR-2753; M-181) Avail: NTIS HC $4.50 CSCL 08G

The low gravity environment of earth orbit offers the potential for performing experiments involving baroclinic Geophysical Fluid Dynamics (GFD) on spherical surfaces. These experiments in turn have the potential for providing deeper understanding of large scale planetary and solar circulations. However, to perform these experiments, one requires an experimental technique whereby a radially directed body force can be generated to simulate a radial gravitational force field. One viable technique is the use of dielectric fluids with temperature dependent dielectric permittivity in a radially directed electric field. Application of the Boussinesq approximation to the equations of motion for this system and restrictions on the size of certain electrodynamic terms in the energy equations yields a set of equations which are analogous to the equations of motions of geophysical systems like the earth's atmosphere on term by term basis. The theoretical design of GFD experiments for performance in earth orbit are described along with results of preliminary tests of a prototype. Author

N76-33818# World Meteorological Organization, Geneva (Switzerland).
REPORT OF THE ELEVENTH SESSION OF THE JOINT ORGANIZING COMMITTTEE Global Atmospheric Research Program
1975 243 p Conf. held at Tokyo, 1-8 Oct. 1975 Prepared jointly with ICSU, Rome
Avail: NTIS HC $8.00; WMO, Geneva

Reports on the status of the FGGE and various GARP subprograms are presented. Projects related to GARP are reviewed and the organization of future work is considered. Annexes give reports of ad-hoc meetings on observational strategies, ocean-atmospheric models, numerical experimentation, and monsoon experiments. ESA

N76-33819# Stockholm Univ. (Sweden).
ENERGY AND CLIMATE
Bert Bolin Secretariat for Future Studies Nov. 1975 58 p refs Sponsored by the Secretariat for Future Studies
Avail: NTIS HC $4.50

A summary of knowledge of those mechanisms that determine the climate of the earth is given, and the possibility that man, directly or indirectly, may influence the climate is discussed. Topics dealt with include climatic changes since the last glaciation, some aspects of the general circulation of the atmosphere and its importance on the distribution of climatic zones on the earth, energy fluxes in the climatic system, climatic changes and their possible causes, and possible future climatic changes caused by an increasing energy production. ESA

N76-33820# National Oceanic and Atmospheric Administration, Rockville, Md. Federal Coordinator for Marine Environmental Prediction.
FEDERAL PLAN FOR MARINE ENVIRONMENTAL PREDICTION FISCAL YEAR 1976
Jan. 1976 54 p
(PB-253927/8; NOAA-S/T-76-1820; NOAA-76031506) Avail: NTIS HC $4.50 CSCL 04B

The Federal Plan is the fifth consecutive annual summary of Federal Marine Environmental Prediction (MAREP) Services and supporting research for the development of new or enhanced services. Basic MAREP data services, and Specialized MAREP services for support of maritime commerce, water quality assessment, living marine resources, and national security are discussed. Oceanographical and meteorological research and specialized MAREP research are included, as well as a discussion of international activities and a summary of 1975-76 fiscal year data. GRA

N76-33821# National Environmental Satellite Service, Washington, D.C.
ATLANTIC TROPICAL AND SUBTROPICAL CYCLONE CLASSIFICATIONS FOR 1975
D. C. Gaby, J. B. Lushine, B. M. Mayfield, S. C. Pearce, and K. O. Poteat Mar. 1976 21 p refs
(PB-253968/2; NOAA-TM-NESS-75; NOAA-76042201) Avail: NTIS HC $3.50 CSCL 04B

Estimates of the locations and maximum sustained winds of all named tropical and subtropical cyclones in the North Atlantic Ocean, the Caribbean Sea, and the Gulf of Mexico were made using techniques developed by Dvorak (tropical) and Herbert and Poteat (subtropical). These techniques were applied to pictures from the Synchronous Meteorological Satellite SMS1. The estimates were compared with the National Hurricane Center's 'best tracks' data to establish the measure of accuracy achieved. These results and other information are presented together with an assessment of the capability of the present operational satellite system. GRA

N76-33822# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
WIND FIELD AND TRAJECTORY MODELS FOR TORNADO-PROPELLED OBJECTS
G. Redmann, J. Radbill, J. Marte, P. Dergarabedian, and F. Fendell Feb. 1976 166 p refs Sponsored by the Elec. Power Res. Inst.
(PB-251138/4; EPRI-308-1) Avail: NTIS HC $6.75 CSCL 04B

As part of a research program to develop a mathematical model to bound the impact characteristics of tornado-propelled objects based on verifiable experimental data, this phase consists of the following tasks: (1) define the worst-case tornado and its associated wind field; (2) survey the availability of aerodynamic coefficients for the postulated missiles; (3) develop a model which will evaluate the sensitivity of the preimpact characteristics to uncertainties in the aerodynamic data; (4) identify significant areas requiring additional research. This report presents in great detail the physical characteristics, conditions, and mathematical formulations upon which the worst-case tornado, its associated wind field and the trajectory model are based. GRA

N76-33823# National Oceanic and Atmospheric Administration, Boulder, Colo. Air Resources Lab.
WIND ENERGY FLUX CALCULATED FROM IDAHO NATIONAL ENGINEERING LABORATORY (INEL) SENSOR NETWORK DATA
John H. Cate and Robert G. Nisle Jul. 1975 61 p refs
(PB-253205/9; NOAA-TM-ERL-ARL-54; NOAA-76030502) Avail: NTIS HC $4.50 CSCL 04B

Computer programs to calculate root mean cube of windspeed, developed for Project Aquilla, are presented with details of their use. Data from the Idaho National Engineering Laboratory (INEL) wind sensing network for 1968 through 1970 and 1972 through

April 1975 serve as input. From these data, the programs calculate the available energy flux for the upper Snake River plain. GRA

N76-33824# Chicago Univ., Ill. Lab. for Atmospheric Probing.
SIMULATION OF SINGLE AND MULTIPLE DOPPLER RADAR OBSERVATIONS OF SEVERE CONVECTIVE STORMS Final Report
Ramesh C. Srivastava and Jaroslav Synchra 31 Oct. 1975 8 p Prepared jointly with Ill. Inst. of Tech.
(Grant NOAA-04-3-022-36)
(PB-253133/3; NOAA-76031704) Avail: NTIS HC $3.50 CSCL 04B

Research was undertaken to determine the optimum placement of three doppler radars for the measurement of wind and precipitation fall velocities in convective storms. An optimum configuration of the radars would be one which yields measurements of high accuracy and space resolution, over the largest possible area, the accuracy and resolution of the measurements being prescribed by the intended application. It is recommended that for studies of deep convective storms, a three radar system be placed at the vertice of an isosceles triangle, the altitude of the triangle being about 2D-3D where 2D is the base of the triangle. The distance 2D itself should not exceed 40-50km, otherwise the effects of pulse volume filtering tend to become severe. These recommended distances are dependent upon the depths of the storms under observation, and apply to clouds for which the tops reach a height of at least 10kms above the radars. GRA

N76-33825# Colorado State Univ., Fort Collins, Dept. of Atmospheric Science.
TROPICAL CYCLONE MOTION AND SURROUNDING PARAMETER RELATIONSHIPS
John E. George Dec. 1975 113 p refs
(Grant NOAA-04-5-022-14)
(PB-253060/8; AS-Paper-241; NOAA-76030305; ISSN-0067-0340) Avail: NTIS HC $5.50 CSCL 04B

Ten years of rawinsonde data for 30 stations in the western North Pacific have been composited relative to tropical cyclone center positions. This information is used to study tropical cyclone motion and surrounding parameter relationships. Tropical cyclone motion and lower troposphere surrounding actual and geostrophic flow fields from 1 to 7 degrees radius are very well correlated. This general correlation of surrounding flow features applies equally well for cyclones with different directions of motion, speeds of propagation, intensities, or intensity changes. GRA

N76-33826# National Weather Service, Salt Lake City, Utah. Western Region.
APPLICATION OF THE NATIONAL WEATHER SERVICE FLASH-FLOOD PROGRAM IN THE WESTERN REGION
Gerald Williams Jan. 1976 29 p refs
(PB-253053/3; NOAA-TM-NWS-WR-103; NOAA-76030308) Avail: NTIS HC $4.00 CSCL 04B

The National Weather Service uses four methods to communicate warning information regarding potential flash floods to the general public. A technique using an intensity rain gage network would fill a large void left by present methods. Since very short-term rainfall is the controlling factor in many if not most flash floods, the traditional flash flood guidance based on three hour rainfall which is calculated from antecedent moisture conditions and rainfall duration is not always applicable. A guidance factor related to individual basin characteristics and potential rainfall rates would be more appropriate. GRA

N76-33827# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
METEOROLOGICAL APPLICATIONS OF THE FM DOPPLER RADAR
R. G. Strauch, W. C. Campbell, R. B. Chadwick, and K. P. Moran Dec. 1975 17 p refs
(PB-253052/5; NOAA-TR-ERL-351-WPL-44; NOAA-76030302) Avail: NTIS HC $3.50 CSCL 04B

A scheme has recently been devised that retrieves the Doppler velocity spectrum for each range resolution cell measured by an FM radar. A nearly all weather boundary layer wind profiler appears feasible with this technique. The FM Doppler radar may also be used in precipitation studies requiring low minimum range or variable range resolution. GRA

N76-33828# New York Sea Grant Inst., Albany.
STORM SURGE
N. Arthur Pore (Natl. Weather Service) and Celso S. Barrientos (Natl. Weather Service) Feb. 1976 47 p refs
(PB-253137/4; NYSSGP-AM-75-031; NOAA-76031502; Atlas-Mono-6) Avail: NTIS HC $4.00 CSCL 04B

Storm surges, which are departures of sea level from normal, are of great concern in the New York Bight area whenever hurricanes or extratropical storms approach or cross the coastline. During such storms, sea level can increase to more than 10 feet above normal. Factors significant in storm surge generation are direct wind, atmospheric pressure, water transport by waves, the earth's rotation, rainfall, and coastal configuration. The National Weather Service has developed a numerical model for forecasting hurricane storm surges and a statistical model for forecasting extratropical storm surges. GRA

N76-33829# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
SATELLITE SUPPORT TO THE HIGH PLAINS EXPERIMENT (HIPLEX) ACTIVITIES FOR 1975 Final Report
David W. Reynolds and Thomas H. VonderHaar Dec. 1975 150 p refs
(Contract DI-14-06-D-7630)
(PB-250563/4) Avail: NTIS HC $6.00 CSCL 04B

Final results of a cloud climatology developed using ATS-3 satellite imagery for the three HIPLEX sites (Miles City, Colby-Goodland, Big Spring) are presented. Case study results demonstrate the usefulness of satellite data in determining cloud heights, organization, life time compared to radar, size compared to echo size, and show how satellite sounder data can extend conventional radiosonde data in both space and time. Three years of ATS-3 satellite data were also examined and a subjective classification of mesoscale and synoptic weather features were compiled for the three HIPLEX sites and the northern, central and southern high plains. Also five years of WBAN-10 hourly observation were analyzed and a climatology of convective cloud and precipitation occurrences were compiled. We view these results as only a preliminary look into how satellites can support the HIPLEX experiment. The digital and imagery data gathered during this past summer from the SMS-2 satellite should increase our knowledge of how satellites can support the HIPLEX. GRA

N76-33830# National Weather Service, Silver Spring, Md.
NUMERICAL WEATHER PREDICTION ACTIVITIES REPORT, 1975
1975 50 p refs
(PB-253971/6; NOAA-76050302) Avail: NTIS HC $4.00 CSCL 04B

Activities in numerical weather prediction of the National Meteorological Center and of the Techniques Development Laboratory of the National Weather Service of the U.S.A. are summarized. The contents are outlined as follows: summary of major highlights of research applications and operations changes; research and development in analysis-prediction systems; techniques, development and applications of new products; analysis-forecast systems in operational use in 1975; plans for future operational systems; forecast verifications; and publications. GRA

N76-33831*# Chicago Univ., Ill. Dept. of the Geophysical Sciences.
SPEARHEAD ECHO AND DOWNBURST NEAR THE APPROACH END OF A JOHN F. KENNEDY AIRPORT RUNWAY, NEW YORK CITY
T. Theodore Fujita Mar. 1976 58 p
(Grants NGR-14-001-008; NOAA-04-4-158-1)
(NASA-CR-147980; PB-254009/4; SMRP-RP-137; NOAA-76042114) Avail: NTIS HC $4.50 CSCL 04B

'Downburst cells' which occurred on the John F. Kennedy International runway during a thunderstorm in the New York City area on June 24, 1975 are described. This weather condition interrupted 14 consecutive landing attempts during a 25-minute period and resulted in some damage on the runway. Satellite imageries and charts which identify and explain the weather

condition as it existed at that time are included. It was concluded that there is no solution to this phenomenon and the only precaution would be to detect the downburst cells in advance to prevent any potential hazard. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N76-33832# National Oceanic and Atmospheric Administration, Seattle, Wash. Pacific Marine Environmental Lab.
AN EVALUATION OF FORMULAS FOR ESTIMATING CLEAR-SKY INSOLATION OVER THE OCEAN
R. K. Reed Dec. 1975 31 p refs
(PB-253055/8; NOAA-TR-ERL-352; PMEL-26; NOAA-76030501) Avail: NTIS HC $4.00 CSCL 04A

Recent oceanic data and observations from five coastal sites in the National Weather Service solar radiation network are compared with a formula for computing clear sky insolation derived from the Smithsonian meteorological tables, using a transmission coefficient of 0.7. The results are generally in good agreement, and they suggest that this formula is suitable for computing isolation over the ocean for a wide range of latitudes. The formula from the Smithsonian tables can be used to compute insolation over the oceans with a random error of estimate probably not exceeding 5% for periods of a few days or longer. GRA

N76-33833# Rhode Island Univ., Kingston. Graduate School of Oceanography.
FORTRAN GRAPHICS PROGRAMS FOR PHYSICAL OCEANOGRAPHIC AND TIME SERIES DATA
William P. Kramer and Robert H. Weisberg 1976 98 p refs (Grant NSF OCD-74-01739)
(PB-251191/3; Marine-TR-76; NOAA-76020902) Avail: NTIS HC $5.00 CSCL 08J

A group of FORTRAN programs written to display time series data, X-Y data, and the results of time series analysis are documented. Separate programs are used to plot variables on any combination of linear and logarithmic (base 10) axes. Originally written to plot physical oceanographic data, these programs may be used in wider applications due to their flexibility. Parameters which determine plot size, numbering and labelling of axes are user supplied variables. The data storage device and format are also supplied at execution time. All of these programs are stored in compiled form. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

No abstracts in this category.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N76-33834*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 157, AUGUST 1976
Aug. 1976 79 p refs
(NASA-SP-7011(157)) Avail: NTIS HC $4.00 CSCL 06E

This bibliography lists 228 reports, articles, and other documents introduced into the NASA scientific and technical information system in July 1976. Author

N76-33835*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
BIOMEDICAL ULTRASONOSCOPE Patent Application
Robert D. Lee, inventor (to NASA) Filed 30 Sep. 1976 22 p (NASA-Case-ARC-10994-1; US-Patent-Appl-SN-728369) Avail: NTIS HC $3.50 CSCL 06B

An instrument with a single ultrasonic transducer probe and a linear array of transducer probes permitting three operator modes is described. An 'A' and an 'M' mode scanner were combined with a 'C' mode scanner and a single receiver is used. The 'C' scanner mode enables two-dimensional cross sections of the viewed organ. Video-produced markers enable measurement of the dimensions of the heart. COS/MOS integrated logic circuit components are used to minimize power consumption and permit battery operation. NASA

N76-33836*# Kanner (Leo) Associates, Redwood City, Calif.
CONTROL STUDIES FOLLOWING A DIABETES SURVEY AMONG EMPLOYEES OF A LARGE CHEMICAL FIRM
H. F. Orth, E. Martin, H. Mattern, and F. H. Schmidt Washington NASA Sep. 1976 16 p refs Transl. into ENGLISH from Deut. Med. Woch., Schr. (Stuttgart), v. 97, no. 27, 1972 p 1019-1023
(Contract NASw-2790)
(NASA-TT-F-17240) Avail: NTIS HC $3.50 CSCL 06P

Glucose content in a morning specimen of urine after intake of 50 g glucose the previous evening was measured in 33,356 employees of a large chemical firm. Later, the results of this screening were checked by performing oral glucose tolerance tests (50 g glucose) on subjects chosen at random. Based on the results of the latter test, the initial screening detected only about 1/3 of the previously undiscovered diabetics. Author

N76-33837*# Scientific Translation Service, Santa Barbara, Calif.
CAN AZURE B-EOSIN REPLACE THE MAY-GRUENWALD-GIEMSA STAIN?
Dietrich Wittekind, Vera Kretschmer, and Walter Loehr Washington NASA Oct. 1976 15 p refs Transl. into ENGLISH from Blut (Munich), v. 32, 1976 p 71-78
(Contract NASw-2791)
(NASA-TT-F-17260) Avail: NTIS HC $3.50 CSCL 06A

A new method is described for staining blood and bone marrow smears. It is characterized by the presence of only two dyes, purified Azure B and Eosin in methanol, as stock solutions. Staining results are equivalent to those obtained by using traditional dye mixtures. Unlike these, Azure B-Eosin staining can be standardized and is easier to handle. Correlations between the Azure B-Eosin and May-Gruenwald-Giemsa staining methods are briefly discussed. Author

N76-33838*# Harvard Medical School, Boston, Mass.
CONTROL MECHANISMS OF CIRCADIAN RHYTHMS IN BODY COMPOSITION: IMPLICATIONS FOR MANNED SPACEFLIGHT Final Report
Martin C. Moore-Ede 30 Sep. 1976 136 p refs
(Contract NAS9-14249)
(NASA-CR-151003) Avail: NTIS HC $6.00 CSCL 06P

The mechanisms underlying the internal synchronization of the circadian variations in electrolyte content in body compartments were investigated, and the significance of these oscillations for manned spaceflight were examined. The experiments were performed with a chair-acclimatized squirrel monkey system, in which the animal sits in a chair, restrained only around the waist. The following information was given: (1) experimental methodology description, (2) summary of results obtained during the first contract year, and (3) discussion of the research performed during the second contract year. This included the following topics: physiological mechanisms promoting normal circadian internal synchronization, factors precipitating internal desynchronization, pathophysiological consequences of internal desynchronization of particular relevance to spaceflight, and validation of a chair-acclimatized system. Y.J.A.

N76-33839# Connecticut Univ., Farmington. School of Medicine.
TOXICOLOGY AND METABOLISM OF NICKEL COMPOUNDS Progress Report, 1 Dec. 1974 - 30 Nov. 1975
F. W. Sunderman, Jr. 15 Aug. 1975 32 p refs

(Contract E(11-1)-3140)
(COO-3140-34) Avail: NTIS HC $5.00

The toxicology and metabolism of nickel compounds were investigated in rats and hamsters. The knowledge has included: demonstration that hyperglucagonemia is primarily responsible for the acute hyperglycemic effect of parenteral Ni(II) in rats; demonstration that parenteral injection of Ni(II) in rats produces acute nephropathy with proteinuria and amino aciduria, and with ultrastructural lesions of renal glomeruli and tubules; confirmation of the inhibitory effect of manganese upon the carcinogenicity of Ni3S2 after intramuscular injection in rats, and elucidation of the effects of manganese upon the rates of excretion of nickel, and upon the acute histological reactions produced by Ni3S2; discovery that the antidotal efficacy of triethylenetetramine in acute Ni(II) poisoning in rats is substantially greater than that of other chelating agents. Author (ERA)

N76-33840# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
TOXIC POINT DETERMINATION OF SELECTED HAZARDOUS MATERIALS Final Report, Sep. - Nov. 1975
Richard A. Davis, Ralph N. Terpolilli, and Kenneth C. Back Dec. 1975 12 p refs
(Contract DOT-AS-40079-2)
(PB-250450/4; DOT-MTB-OHMO-75-4) Avail: NTIS HC $3.50 CSCL 06T

Toxic point is a term under consideration by the United Nations group of rapporteurs on the packaging of dangerous goods. It is defined as the temperature at which the equilibrium concentration of vapor of a substance measured at 760 millimeters is equal to the LC50 of the substance. This is also referred to as the temperature threshold of toxicity. The report contains the toxic points calculated for 57 substances. The calculations are shown together with the toxicity and vapor pressure data used therein. GRA

N76-33841# National Bureau of Standards, Washington, D.C.
MEASUREMENTS AND OBSERVATIONS OF THE TOXICOLOGICAL HAZARD OF FIRE IN A METRORAIL INTERIOR MOCK-UP Final Report
M. Paabo, B. Pitt (Johns Hopkins Univ., Baltimore), M. M. Birky, A. W. Coats, and S. E. Alderson Feb. 1976 20 p refs
(PB-250768/9; NBSIR-75-966) Avail: NTIS HC $3.50 CSCL 06T

Oxygen depletion, carbon monoxide, carbon dioxide, hydrogen chloride and hydrogen cyanide were selected for measurement and identification in Metrorail fire tests. Male rats exposed to the combustion products were examined for changes in blood chemistry, gross pathology and loss of function. Hydrogen cyanide and carbon monoxide levels in blood were evaluated and functional changes were noted. GRA

N76-33842# Bureau of Radiological Health, Rockville, Md. Div. of Biological Effects.
A REVIEW OF BIOLOGICAL EFFECTS AND POTENTIAL RISKS ASSOCIATED WITH ULTRAVIOLET RADIATION AS USED IN DENTISTRY
Loren F. Mills, C. David Lytle, F. Allen Andersen, Kiki B. Hellman, and Larry E. Bockstahler Oct. 1975 41 p refs
(PB-254273/6; FDA/BRH-76/40; DHEW/PUBL/FDA-76/8021) Avail: NTIS HC $4.00 CSCL 06R

Dental procedures which utilize ultraviolet radiation are briefly described. The bases for UV safety standards are reviewed. The effects of UV exposure to the skin and eyes and how these effects may relate to oral mucosa exposure are considered. Potential modes of action by UV radiation on oral tissues as suggested by cell culture studies are summarized, and potential risks from UV exposure of individuals which might result from the dental procedures are discussed. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N76-33843# National Bureau of Standards, Washington, D.C.
A NEW LOOK AT THE RESEARCH BASIS FOR LIGHTING LEVEL RECOMMENDATIONS Building Sciences Series, Final Report
Gary T. Yonemura and Yoshimi Kohayakawa Mar. 1976 14 p refs
(PB-253112/7; NBS-BSS-82; LC-76-136) Avail: NTIS HC $3.50 CSCL 13A

The validity of using threshold studies as the basis for lighting level recommendations is questioned. The performance of the eye at suprathreshold levels was investigated with sine- and square-wave gratings. The results of the study indicate that the behavior of the eye is significantly different at suprathreshold levels as opposed to threshold levels. For threshold studies, when contrast is plotted against luminance, the function is a monotonically decreasing function. At suprathreshold levels the function indicates the existence of a definite minimum, luminances greater or less requiring more contrast to appear subjectively equal. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N76-33844# National Aeronautical Lab., Bangalore (India).
ON SIMULATION AND EVALUATION OF AIRCRAFT HANDLING QUALITIES
Rajendra K. Bera Jan. 1976 23 p refs
(NAL-TN-49) Avail: NTIS HC $3.50

Some problems connected with flight simulation and selection of evaluation pilots are discussed. A modified Cooper-Harper scale is suggested which provides separate ratings on the aircraft's longitudinal, and lateral/directional dynamics, and on cockpit management. The ratings were qualified by an alphabetic index which indicates the confidence with which simulation data may be extrapolated to actual flight situations. Author

N76-33845*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NASA AVIATION SAFETY REPORTING SYSTEM Quarterly Report, 15 Apr. - 14 Jul. 1976
Charles E. Billings, John K. Lauber, Hallie Funkhouser, E. Gene Lyman, and Edward M. Huff Washington Sep. 1976 23 p
(NASA-TM-X-3445; A-6743; QR-76-1) Avail: NTIS HC $3.50 CSCL 05B

The origins and development of the NASA Aviation Safety Reporting System (ASRS) are briefly reviewed. The results of the first quarter's activity are summarized and discussed. Examples are given of bulletins describing potential air safety hazards, and the disposition of these bulletins. During the first quarter of operation, the ASRS received 1464 reports; 1407 provided data relevant to air safety. All reports are being processed for entry into the ASRS data base. During the reporting period, 130 alert bulletins describing possible problems in the aviation system were generated and disseminated. Responses were received from FAA and others regarding 108 of the alert bulletins. Action was being taken with respect to 70 of the 108 responses received. Further studies are planned of a number of areas, including human factors problems related to automation of the ground and airborne portions of the national aviation system. Author

N76-33846*# California Univ., Berkeley.
SECONDARY TASK FOR FULL FLIGHT SIMULATION INCORPORATING TASKS THAT COMMONLY CAUSE PILOT ERROR: TIME ESTIMATION Final Technical Report, 1 Nov. 1974 - 31 Oct. 1975
Eleanor Rosch 31 Oct. 1975 32 p refs
(Contract NCA2-OR-050-503)
(NASA-TM-X-74153) Avail: NTIS HC $4.00 CSCL 05E

The task of time estimation, an activity occasionally performed by pilots during actual flight, was investigated with the objective of providing human factors investigators with an unobtrusive and minimally loading additional task that is sensitive to differences

in flying conditions and flight instrumentation associated with the main task of piloting an aircraft simulator. Previous research indicated that the duration and consistency of time estimates is associated with the cognitive, perceptual, and motor loads imposed by concurrent simple tasks. The relationships between the length and variability of time estimates and concurrent task variables under a more complex situation involving simulated flight were clarified. The wrap-around effect with respect to baseline duration, a consequence of mode switching at intermediate levels of concurrent task distraction, should contribute substantially to estimate variability and have a complex effect on the shape of the resulting distribution of estimates. Author

N76-33847# Auburn Univ., Ala. School of Engineering.
COMPUTER MODELING OF THE BODY-HEAD-HELMET SYSTEM, VOLUME 1 Final Report
Wartan A. Jemian and Nan-Heng Lin Feb. 1976 96 p refs
(Contract DABT01-74-C-0231)
(AD-A023785; USAARL-76-13-Vol-1) Avail: NTIS CSCL 06/17

Three dimensional finite element methods of analysis were applied to the body-head-helmet structural system under conditions of static equilibrium and to the head-helmet assembly in a dynamic mode. Computer programs were written to generate the three dimensional grids, to evaluate inertial properties, and to process and display results of the structural analyses. Static analysis, using a fixed configuration, is applicable to the description of displacement and stress component fields in the system. The results of this mode of analysis have the potential of yielding information related to loss of consciousness due to impact situations. Dynamic structural analysis was performed on a computer generated pseudospherical model simulating the drop test. Results provide time traces of the displacement, velocity, acceleration, and stress components at selected nodal points and elements of the system. Methods were demonstrated for the determination of a number of parameters of potential or proven value in evaluating crash protection or crash severity. These include linear acceleration profile, rotational acceleration profile, shear stress, skull deflection, severity index, mass moments of inertia, and regional centers of gravity. Six specific recommendations were made for steps to be taken in applying finite element simulation to helmet design. GRA

N76-33848# Auburn Univ., Ala. School of Engineering.
COMPUTER MODELING OF THE BODY-HEAD-HELMET SYSTEM. VOLUME 2: FINITE ELEMENT COORDINATES AND COMPUTER PROGRAM SUBROUTINES FOR A BODY-HEAD-HELMET SYSTEM Final Report
Wartan A. Jemian and Nan-Heng Lin Feb. 1976 77 p refs
(Contract DABT01-74-C-0231)
(AD-A023786; USAARL-76-13-Vol-2) Avail: NTIS CSCL 06/17

The report is a supplement to the basic report entitled, 'Computer Modeling of the Body-Head-Helmet System'. As such, it should be used with the basic report for maximum clarity. Nodal point coordinates and boundary conditions for a fixed Body-Head-Helmet configuration are listed. A 3X3X3 pseudosphere head-helmet configuration is also listed. A listing of service in FORTRAN calls on the facilities and subprograms of the IBM operating system and the Calcomp Plotter. The service listed should perform all of the operations referred to in the basic report. GRA

N76-33849# Braddock, Dunn and McDonald, Inc., El Paso, Tex.
SEEKVAL PROJECT IAI: EFFECTS OF TARGET NUMBER AND CLUTTER ON DYNAMIC TARGET ACQUISITION Final Report
Robert L. Hilgendorf and John Milenski Wright-Patterson AFB, Ohio AMRL Jan. 1976 92 p refs
(Contract F33615-73-C-4106; AF Proj. 7184)
(AD-A024166; AMRL-TR-74-4) Avail: NTIS CSCL 17/8

This report describes an experiment conducted to obtain data for use in determining the effects of a number of targets and background clutter elements on visual target detection performance by means of the unaided eye. Data obtained from this experiment consist mainly of whether or not single or groups of tank targets within controlled clutter (defined as tree density) configurations were detected, and the times of detection. Statistical methods, including analysis of variance tests and Newman-Keuls tests, are employed to assess the effects of target and clutter factors on detection performance. For this experiment, the effects of number of targets were determined to be more important than those of clutter on detection performance, and there were no significant effects due to interaction between targets and clutter elements. Author (GRA)

N76-33850# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
AN ICE-COOLING GARMENT FOR MINE RESCUE TEAMS
Maria I. DeRosa and Richard L. Stein May 1976 19 p refs
(PB-254487/2; BM-RI-8139) Avail: NTIS HC $3.50 CSCL 06Q

High temperatures encountered by mine rescue teams during emergency situations may cause severe physiological strain, hindering the men from carrying out rescue and recovery missions. A prototype ice cooling garment (ICG) has been developed to alleviate physiological strain due to heat stress. The effectiveness of the garment was tested with acclimatized and unacclimatized subjects at a typical work rate expected during rescue operations and at various hot environments. Both heart rate and skin temperature values were lower while wearing the ICG. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering.*

N76-33851*# Tennessee Univ., Knoxville. Dept. of Electrical Engineering.
ARCHITECTURE AND DATA PROCESSING ALTERNATIVES FOR TSE COMPUTER. VOLUME 1: TSE LOGIC DESIGN CONCEPTS AND THE DEVELOPMENT OF IMAGE PROCESSING MACHINE ARCHITECTURES Final Report, May 1974 - Aug. 1976
Dale A. Rickard and R. E. Bodenheimer Sep. 1976 274 p refs
(Grant NsG-5002)
(NASA-CR-148837; TR-EE/CS-76-1) Avail: NTIS HC $9.00 CSCL 09B

Digital computer components which perform two dimensional array logic operations (Tse logic) on binary data arrays are described. The properties of Golay transforms which make them useful in image processing are reviewed, and several architectures for Golay transform processors are presented with emphasis on the skeletonizing algorithm. Conventional logic control units developed for the Golay transform processors are described. One

is a unique microprogrammable control unit that uses a microprocessor to control the Tse computer. The remaining control units are based on programmable logic arrays. Performance criteria are established and utilized to compare the various Golay transform machines developed. A critique of Tse logic is presented, and recommendations for additional research are included. Author

N76-33852*# Tennessee Univ., Knoxville. Dept. of Electrical Engineering.
ARCHITECTURE AND DATA PROCESSING ALTERNATIVES FOR THE TSE COMPUTER. VOLUME 2: EXTRACTION OF TOPOLOGICAL INFORMATION FROM AN IMAGE BY THE TSE COMPUTER Final Report, May 1974 - Aug. 1976
James R. Jones and R. E. Bodenheimer Sep. 1976 108 p refs
(Grant NsG-5002)
(NASA-CR-148835; TR-EE/CS-76-2) Avail: NTIS HC $5.50 CSCL 09B

A simple programmable Tse processor organization and arithmetic operations necessary for extraction of the desired topological information are described. Hardware additions to this organization are discussed along with trade-offs peculiar to the tse computing concept. An improved organization is presented along with the complementary software for the various arithmetic operations. The performance of the two organizations is compared in terms of speed, power, and cost. Software routines developed to extract the desired information from an image are included. Author

N76-33853*# Tennessee Univ., Knoxville. Dept. of Electrical Engineering.
ARCHITECTURE AND DATA PROCESSING ALTERNATIVES FOR THE TSE COMPUTER. VOLUME 3: EXECUTION OF A PARALLEL COUNTING ALGORITHM USING ARRAY LOGIC (TSE) DEVICES Final Report, May 1974 - Aug. 1976
Alan G. Metcalfe and R. E. Bodenheimer Sep. 1976 84 p refs
(Grant NsG-5002)
(NASA-CR-148836; TR-EE/CS-76-3) Avail: NTIS HC $5.00 CSCL 09B

A parallel algorithm for counting the number of logic-l elements in a binary array or image developed during preliminary investigation of the Tse concept is described. The counting algorithm is implemented using a basic combinationai structure. Modifications which improve the efficiency of the basic structure are also presented. A programmable Tse computer structure is proposed, along with a hardware control unit, Tse instruction set, and software program for execution of the counting algorithm. Finally, a comparison is made between the different structures in terms of their more important characteristics. Author

N76-33854# Sandia Labs., Albuquerque, N.Mex.
VISAR DATA REDUCTION
E. G. Young and L. M. Barker Nov. 1975 65 p refs
(Contract AT(29-1)-789)
(SAND-75-0424) Avail: NTIS HC $5.50

The data reduction theory which allows both specimen surface velocity and surface velocity distribution to be determined from the data of the velocity interferometer system for any reflector is presented. Two time-sharing, user-interactive computer programs which implement the theory are described, and the program listings are provided. Author (ERA)

N76-33855# Oak Ridge National Lab., Tenn.
FBSAM DATA TRANSMISSION PACKAGE FOR IBM 360/370 COMPUTERS
W. A. Rhoades Jan. 1976 53 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5199) Avail: NTIS HC $5.50

The FBSAM subroutine package provides rapid movement of large blocks of data directly between user storage arrays and magnetic disk data sets. No buffer space is required. Large reductions in data transmission time and number of I/O requests can be obtained. Moves can be concurrent with each other and with computation. A form of random access is available. A demonstration program provides a thorough test of all features. The package is intended for use by FORTRAN programers with little or no assembler language experience. It should be operable on most IBM 360/370 machines. A sample application to an I/O-bound code is discussed. The use of three concurrent functions entirely eliminated the real time associated with data transmission tasks by allowing them to proceed concurrently with other tasks. Author (ERA)

N76-33856# California Univ., Berkeley. Lawrence Berkeley Lab.
GRAPHICS MODELING TECHNIQUES IN COMPUTER AIDED DESIGN
H. H. Holmes Nov. 1975 201 p refs
(Contract W-7405-eng-48)
(LBL-4240) Avail: NTIS HC $7.75

A comprehensive approach to problem solving using schematic diagrams as the interface between man and computer is described. A single man machine problem description interface for use in a wide variety of problem solving disciplines is provided. Intermediate data structures and preprocessing facilities that form a natural interface and starting point for the creation of additional analysis capabilities are included. The problem definition interface supports two main activities: the creation of elements and the interconnection of these elements to form diagrammatic models. The problem solving portion of the methodology allows a wide variety of analysis techniques which can be flexibly combined to solve a particular problem at hand. Extension of existing problem solving systems using the graphics problem description interface is also described. Author (ERA)

N76-33857# United Kingdom Atomic Energy Authority, Harwell (England).
DATA PROCESSING FACILITIES IN THE HARWELL 6000 SERIES
G. I. Phillips, G. Wakefield, and I. Hawthorn Jan. 1976 30 p refs
(AERE-R-8240) Avail: ERDA Depository Libraries HC $4.00 £1.50

A wide variety of systems which were assembled from the Harwell 6000 series units are discussed. The data processing facilities are described, with emphasis on the readout of data to various recording devices ranging from strip printer to minicomputer and the readsin of data from peripheral devices to systems stores. Author (ERA)

N76-33858# California Univ., Livermore. Lawrence Livermore Lab.
COMPUTER MEMORY: THE LLL EXPERIENCE
J. G. Fletcher Feb. 1976 14 p refs Presented at Advanced Memory Concepts Workshop, Menlo Park, Calif., 23 Mar. 1976
(Contract W-7405-eng-48)
(UCRL-77863; Conf-760319-1) Avail: NTIS HC $3.50

Those aspects of Octopus computer network design are reviewed that relate to memory and storage. Emphasis is placed on the difficulties and problems that arise because of the limitations of present storage devices, and indications are made of the directions in which technological advance could be of most value. Author (ERA)

N76-33859# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
DESIGN OF A DATA ACQUISITION SYSTEM FOR THE GRAVITATIONAL EXPERIMENT [PROGETTO DI UN SISTEMA DI ACQUISIZIONE DATI PER L'ESPERIMENTO GRAVITAZIONALE]
G. Vannaroni Apr. 1976 44 p refs In ITALIAN
(LPS-76-15) Avail: NTIS HC $4.00

The system for data acquisition from a gravitational wave experiment is discussed. The real time program is described together with the tape recorder unit and the digital multiplexer. Detailed technical documentation is attached. ESA

N76-33860# Perceptronics, Inc., Woodland Hills, Calif.
MAN/MACHINE INTERACTION IN ADAPTIVE COMPUTER-AIDED CONTROL Final Annual Technical Report, 15 Nov. 1974 - 15 Nov. 1975
Randall Steeb, Marlene Artof, William H. Crooks, and Gershon Weltman 30 Dec. 1975 93 p refs

(Contract N00014-72-C-0093; NR Proj. 196-118)
(AD-A021323; PATR-1008-75-12/31) Avail: NTIS CSCL 09/2

Shared decision making between man and intelligent machine is becoming an important part of advanced systems. The research described in this paper is directed toward developing human factors criteria for the man/machine interaction. The research effort includes evaluations of task allocation techniques, information feedback, and decision analysis methods. The report presents the results of a series of experimental investigations of adaptive computer-aided control. The report includes (1) a review of shared decision making and control with intelligent machines (2) an analysis of decision processes and performance in shared control tasks (3) a description of a representative shared control simulation involving remotely piloted vehicle guidance and (4) a series of experiments centering on methods of automatic control allocation and feedback. The results of the investigation suggest that automatic allocation of control based on estimated operator utilities or on objectively defined values is of advantage in shared control. The choice of allocation criteria and feedback type both depend strongly on the situation. Performance (objective value) based allocation and feedback both resulted in control proportions closer to the optimal amount than preference based allocation. GRA

N76-33861# Perceptronics, Inc., Woodland Hills, Calif.
MAN/MACHINE INTERACTION IN ADAPTIVE COMPUTER-AIDED CONTROL: HUMAN FACTORS GUIDELINES Technical Report, Nov. 1971 - Nov. 1975
Randall Steeb, Gershon Weltman, and Amos Freedy 31 Jan. 1976 49 p refs
(Contract N00014-72-C-0093; NR Proj. 196-118)
(AD-A021721; PATR-1008-76-1/31) Avail: NTIS CSCL 09/2

This report provides in guideline form a summary of the investigations, findings and recommendations compiled in a series of studies of adaptive computer aided control. These studies, spanning the four year period from November 1971 to November 1975, were directed toward developing human factors criteria for the interaction between man and intelligent machine. The areas considered include: (1) the range of application of adaptive aiding, (2) characteristics of adaptive control systems, (3) allocation of control function, (4) man/machine communication, (5) operator selection and training, and (6) system performance analysis methods. Author (GRA)

N76-33862# Mitre Corp., Bedford, Mass.
THE MULTI-MINICOMPUTER PROCESSOR
D. D. Coffin and H. E. T. Connell Feb. 1976 58 p refs
(Contract F19628-76-C-0001; AF Proj. 6290)
(AD-A021777; MTR-3072; ESD-TR-75-351) Avail: NTIS CSCL 17/9

The digital snapshot moving target indication (MTI) technique was developed for the GEODSS project in FY-75. GEODSS is a Ground-based Electro-Optical Deep Space Surveillance System. This document describes the computer hardware used as a vehicle on which suitable real-time MTI implementation could be tested. The computer hardware consists of ten interconnected Data General Corporation 800 series computers and their associated peripherals. This multi-minicomputer processor (MMCP) constitutes sufficient computing power to achieve an operational real-time MTI processor. Author (GRA)

N76-33863# Mitre Corp., Bedford, Mass.
MTI PROCESSOR SOFTWARE
D. D. Coffin and H. E. T. Connell Feb. 1976 251 p refs
(Contract F19628-76-C-0001; AF Proj. 6290)
(AD-A021778; MTR-3071; ESD-TR-75-352) Avail: NTIS CSCL 17/9

This section describes the structure for the snapshot MTI demonstration software. Each element resides in a separate minicomputer. Inter computer data transfer is accomplished over the MCA data bus which is common to all processing elements. The digital representation of the telescope field of view (FOV) enters the MTI processor from the preprocessor to the PIM (Preprocessor Interface Minicomputer). In the demonstration program, the entire frame of data is passed on directly to the DIM (Disc Interface Minicomputer). The PIM also determines the bounds within the frame that are necessary to distribute portions of the FOV to each cancellation computer. The raster scan of the FOV is split into 4 strips of equal area by examination of the y coordinate. All detections in each strip are sent to the proper CAM to serve as a reference frame. Each CAM functions as a Cancellation Minicomputer. The DIM also splits the FOV into 4 equal area strips for distribution to the CAMS after applying a digital threshold. GRA

N76-33864# Federal COBOL Compiler Testing Service, Washington, D.C.
IBM COBOL COMPILER: OS/VSR2 VS COBOL VERSION 1 R1.1
Apr. 1976 47 p Revised
(AD-A024088; CCVS68-VSR135) Avail: NTIS CSCL 09/2

This Validation Summary Report (VSR) provides a consolidated summary of the results obtained from the validation of the subject compiler. The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies by Federal level module; a section relating the categories of discrepancies to each of the Federal levels of the language; and a detailed listing of discrepancies together with the tests which were failed. GRA

N76-33865# Federal COBOL Compiler Testing Service, Washington, D.C.
COBOL COMPILER VALIDATION SUMMARY REPORT: HIS 6000 COBOL STD-68 3/I E GCOS 3
Apr. 1976 32 p
(AD-A023663; CCVS68-VSR140) Avail: NTIS CSCL 09/2

This Validation Summary Report (VSR) provides a consolidated summary of the results obtained from the validation of the subject compiler. The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies to each of the Federal levels of the language; and a detailed listing of discrepancies together with the tests which were failed. GRA

N76-33866# Illinois Univ., Urbana. Coordinated Science Lab.
M AND M SYSTEM DESIGN AND OPERATION
Charles Jerimiah Jacobus Dec. 1975 74 p refs
(Contracts DAAB07-72-C-0059; F33615-73-C-1238)
(AD-A023443; R-709; UILU-ENG-75-2245) Avail: NTIS CSCL 09/2

This document describes the operation and design of a multiprogramming operating system written for the PDP-11/40 with memory management option. No particular system device is required in that all system modules reside in core. Control commands are issued through one system console and multiprocessing is initiated from a root task started through commands typed to this console. This system is primarily single user with multiprocessing options. Author (GRA)

N76-33867# Federal COBOL Compiler Testing Service, Washington, D.C.
DECSYSTEM-10 1080, DECSYSTEM-10 COBOL VERSION 10 Validation Summary Report
12 Apr. 1976 60 p
(AD-A023270; CCVS68-VSR130) Avail: NTIS CSCL 09/2

This Validation Summary Report (VSR) provides a consolidated summary of the results obtained from the validation of the subject compiler. The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies by Federal level module; a section relating the categories of discrepancies to each of the Federal levels of the language; and a detailed listing of discrepancies together with the tests which were failed. Author (GRA)

N76-33868# Environmental Protection Agency, Washington, D.C. Office of Research and Development.
PROCEEDINGS NUMBER 2 OF THE ORD AND ADP WORKSHOP
Denise Swink Apr. 1976 205 p refs Workshop held at Gulf Breeze, Fla., 11-13 Nov. 1975
(PB-253981/5; EPA-600/9-76-008) Avail: NTIS HC $7.75 CSCL 09B

The second ORD ADP workshop focused on the merits of

past data acquisition and manipulation techniques and procedures, and provided suggestions for new approaches from the views of both providers and users of ADP resources. Subject areas included instrumentation, process control and data management aspects of laboratory automation; strengths and weaknesses of scientific analysis; utility of environmental data bases; developments in remote sensing projects, and future developments in EPA ADP resources. GRA

N76-33869# National Bureau of Standards, Washington, D.C.
GLOSSARY FOR COMPUTER SYSTEMS SECURITY Final Report
Dennis Branstad and Robert Krell 15 Feb. 1976 25 p refs
(PB-251212/7; FIPS-PUB-39) Avail: NTIS HC $3.50 CSCL 09B

An alphabetic listing is presented of approximately 170 terms and definitions pertaining to privacy, and security related to data, information systems hardware and software. Multiple word terms are listed in natural order, synonyms are referenced, and glossary terms appearing within a definition are indicated. GRA

N76-33870# British Library Lending Div., Boston Spa (England).
ON-LINE INPUT TECHNIQUES FOR BIBLIOGRAPHIC DATA
P. Simmons and T. Lambe Mar. 1976 84 p Sponsored by Dept. of Education and Science (Engl.)
(BLL-BLRDR-5273-(2113.56F)) Avail: British Library Lending Div., Boston Spa, Engl.

Experiments were carried out into the use of on-line techniques for handling bibliographic data. During the initial program development, some general purpose communications routines were written to supplement the manufacturer's VDU software. This was followed by the implementation of an on-line accessions control system which provided useful experience for the project staff in on-line programming techniques. Limited trials of the system were carried out by accessions staff whose assessment is given in this report. The other main phase of the project carried out experiments in generalized display and editing procedures. Two approaches were used to display bibliographic data containing a complex character set and two different editing systems were developed and compared. Author

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N76-33871# European Organization for Nuclear Research, Geneva (Switzerland).
INSTRUCTION TIMING FOR THE CDC 7600 COMPUTER
H. Lipps 22 Dec. 1975 78 p
(CERN-75-19) Avail: ERDA Depository Libraries HC $5.00

This report provides timing information for all instructions of the Control Data 7600 computer, except for instructions of type 01X, to enable the optimization of 7600 programs. The timing rules serve as background information for timing charts which are produced by a program (TIME76) of the CERN program library. The rules that coordinate the different sections of the CPU are stated in as much detail as is necessary to time the flow of instructions for a given sequence of code. Instruction ,etch, instruction issue, and access to small core memory are tested at length, since details are not available from the computer manuals. Annotated timing charts are given for 24 examples chosen to display the full range of timing considerations.
Author (ERA)

N76-33872# California Univ., Livermore. Lawrence Livermore Lab.
PLOTPK: AN INTERRACTIVE PROGRAM THAT CREATES GRAPHS AND EDITS PICTURES. PART 1: USER'S GUIDE
P. Keller 22 Jan. 1976 29 p refs
(Contract W-7405-eng-48)
(UCID-30127-Pt-1) Avail: NTIS HC $4.00

The PLOTPK program is a quick and easy way of plotting data, and a flexible means of analyzing it. The program contains the tools deeded to create two- and three-dimensional graphs and send them to a TMDS screen, RJET printer, or FR80-generated film. A scientist or engineer can use PLOTPK to scan a volume of data, looking for correlations between parameters and visually validating the data. Although PLOTPK does not validate raw data, it does present it in different forms so that the user can evaluate it at a glance. Because PLOTPK is designed to make it easy for the user to interact with the data, it is not appropriate for production jobs involving hundreds of pictures a day. It is, however, an efficient tool for production in which just a few pictures per day are generated, for in such a case it is quicker to use the PLOTPK program than to write a new one.
Author (ERA)

N76-33873# California Univ., Livermore. Lawrence Livermore Lab.
PLOTPK: AN INTERACTIVE PROGRAM THAT CREATES AND EDITS PICTURES. PART 2: REFERENCE MANUAL
Pete Keller 30 Dec. 1975 73 p ref
(Contract W-7405-eng-48)
(UCID-30127-Pt-2) Avail: NTIS HC $4.50

Part 1 describes (with pictures and examples) the quick and easy ways of generating plots. PLOTPK is a convenient way of plotting data and a flexible means for analyzing it. The PLOTPK program contains the tools one needs to create graphs. Once such a picture is created, the user can select the medium to send it out on: TMDS screen, RJET printer, or FR80-generated film. A scientist or engineer can use PLOTPK to scan a volume of data from his research to look for correlations between parameters or to validate the data visually. Although PLOTPK does not validate raw data, it does present the data in various forms so that the user can evaluate it at a glance--in many cases, he is better able to validate the data than is any mathematical subroutine. The PLOTPK program is designed to make it easy for the user to interact with the data, and hence is not designed for production jobs involving hundreds of pictures per day. Author (ERA)

N76-33874# Ames Lab., Iowa.
USERS MANUAL FOR OS910, THE SDS-910 OPERATING SYSTEM
L. C. Moon Dec. 1975 33 p refs
(Contract W-7405-eng-82)
(IS-3773) Avail: NTIS HC $4.00

This document is designed for the users of the OS910 realtime operating system for the SDS-910-PDP-15 computer network. Information the user must provide to the system for successful operation is described. A description of all programmed operators that will be of use to the user is included. Author (ERA)

N76-33875# Ames Lab., Iowa.
ALECS LANGUAGE REFERENCE MANUAL
J. H. Campbell, G. F. Covert, and B. J. Helland Jan. 1976 97 p refs
(Contract W-7405-eng-82)
(IS-3339) Avail: NTIS HC $5.00

The Ames Laboratory Experimental Control System (ALECS) programming language is a subset of the PL/1 programming language. This manual supplements the PL/1 reference manual by detailing the additions to the PL/1 language as well as listing the implementation restrictions where appropriate.
Author (ERA)

N76-33876# Kernforschungszentrum, Karlsruhe (West Germany).
IPOL: A FORTRAN ROUTINE FOR TWO DIMENSIONAL INTERPOLATION
C. Guenther Nov. 1975 32 p In GERMAN
(KFK-2175) Avail: ERDA Depository Libraries HC $4.00

Let a set of N real points, (x/sub i/, y/sub i/), i = 1, 2, ..., N, be given. The FORTRAN subroutine IPOL calculates a maximum number v greater than or equal to 1 of linearly independent polynominals, P sub 1 (x,y), ..., P/sub v/(x,y), which are of least possible degree g and which have the (x/sub i/, y/sub i/) as zeros, P/sub K/(x/sub i/, y/sub i/) = 0 for i = 1, 2, ..., N and K = 1, ..., v. IPOL is used to find polynominals P(x,y) vanishing in a given point set. This is done by setting P(x,y): = P sub 1 (x,y) if v = 1, and if v > 1 by taking a

suitable linear combination of P sub 1 (x,y), ..., P/sub v/(x,y). An example is given for a multivariate interpolation problem. In addition, an aspect of numerical integration can be clarified by the use of IPOL. For some quadrature formulas of polynominal degree 2l-1 in two dimensions, the number of linearly independent polynominals of degree l which have the points of these formulas as zeros is given. Author (ERA)

N76-33877# Stuttgart Univ. (West Germany).
CONTROL ALGORITHMS FOR DIGITAL CONTROL WITH PROCESS COMPUTERS: SYNTHESIS, SIMULATION, COMPARISON
R. Isermann, D. Bux, P. Blessing, and P. Kneppo Aug. 1975 139 p In GEORGIAN
(KFK-PDV-54) Avail: ERDA Depository Libraries HC $3.00

Methods for the design of parameter-optimized, deadbeat, and state variable control algorithms are described, which are especially suited for computer-aided design. It is assumed that a process model in parametric and time-discrete form was obtained by process identification. Results of simulations give hints for the design, especially for the selection of sampling time and the weighing factor of the process input. Eight selected control algorithms are compared with regard to the resulting control performance, sensitivity for inexact process models, computing time between samples, computing time and storage for synthesis with process computers. Finally, methods for the design of feed forward control algorithms are described. Author (ERA)

N76-33878# California Univ., Livermore. Lawrence Livermore Lab.
HIGH LEVEL LANGUAGES IN MICROCOMPUTER AUTOMATION
E. R. Fisher 26 Feb. 1976 6 p refs Presented at ELECTRO-76, Boston, 11 May 1976 Sponsored by ERDA
(UCRL-77868; Conf-760502-1) Avail: NTIS HC $4.50

With the increasing use of microcomputers in scientific instrumentation, it is important to discuss the possibility of providing an instrument with built-in computer control. Programming techniques which allow the scientist or operator to control interactively the configuration of an experiment are described. To program his application the scientist will communicate with his instrument by means of an immediately interactive high-level language. The feasibility of providing this type of capability on microcomputers was studied by examining and comparing the PL-1-like language PLM and BASIC. ERA

N76-33879# Kernforschungszentrum, Karlsruhe (West Germany). Inst. Fuer Datenverarbeitung in der Technik.
TOOL FOR THE SIMULATION OF THE DYNAMIC BEHAVIOR OF OPERATING SYSTEM SOFTWARE
M. Rupp and J. Nehmer Nov. 1975 31 p
(KFK-2229) Avail: ERDA Depository Libraries HC $4.00

The characteristics of a simulation system to study the dynamic behavior of operating system software in detail are described. The use of the system, which appears to the application programmer like a virtual PL/1 machine, is illustrated by an example. Author (ERA)

N76-33880# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
I/O SYSTEM IN BASIC LANGUAGE FOR THE HP2116B COMPUTER (IOB4) [SISTEMA DI INGRESSO-USCITA IN LINGUAGGIO BASIC PER IL CALCOLATORE HP2116B (IOB4)]
P. Cerulli-Irelli Apr. 1975 20 p refs In ITALIAN
(LPS-75-11) Avail: NTIS HC $3.50

Updates and summaries are given of precedent notes on the HP2116B computer and its associated programs in BASIC programming language as interfaces between the central processing unit and its peripheral units. The principal features and construction of the input/output system are described. ESA

N76-33881# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
UTILITY PROGRAMS FOR THE OPERATION OF ONE-WORD-BITS IN THE IBM 370/125 COMPUTER AND THE DATA TRANSFER IN BINARY FORM BETWEEN THE HP2116B, IBM 370/125, AND UNIVAC 1110 COMPUTERS [PROGRAMMI DI UTILITA: A)PER OPERARE SUI BITS DI UNA PAROLA DEL CALCOLATORE IBM 370/125; B)PER TRASFERIRE DATI IN FORMA BINARIA TRA I CALCOLATORI HP2116B, IBM 370/125, UNIVAC 1110]
B. Bavassano and C. Signorini May 1975 41 p refs In ITALIAN
(LPS-75-18) Avail: NTIS HC $4.00

A set of computer programs to convert binary strings represented on a given type of computer to any other computer representation is presented. The binary representation of numbers is detailed for each of the computers considered together with the relevant bit manipulating subroutines. Examples are given. ESA

N76-33882# Rome Air Development Center, Griffiss AFB, N.Y.
A BASIC STATISTICS COLLECTOR
Douglas A. White Mar. 1976 59 p refs
(AF Proj. 5581)
(AD-A023494; RADC-TR-76-9) Avail: NTIS CSCL 09/2

The Beginner's All-Purpose Symbolic Instruction Code (BASIC) is an algebraic problem oriented programming language. BASIC allows the programmer to write his program largely in common mathematical notations using the simple statements of the language. BASIC is intended for interactive use such as is found on a terminal oriented time-sharing system. This report contains a description of a tool designed and implemented to be used in collecting and analyzing data that will assist in identifying the manner in which the programming language BASIC is used by programmers in writing programs. The initial design and implementation of the tool to provide statistics concerning the BASIC language is described. An explanation is given of the types of data collected and the method in which the data were collected. Explanations of current analysis methods, sources of data and results are provided along with possible conclusions that may be drawn from the results. GRA

N76-33883# National Cancer Inst., Bethesda, Md. Image Processing Unit.
DDTG: FUNCTIONAL SPECIFICATION FOR THE RTPP MONITOR/DEBUGGER Final Technical Report
Peter Lemkin 5 Feb. 1976 95 p refs
(PB-250726/7; NCI/IP-76/02; FR-2) Avail: NTIS HC $5.00 CSCL 09B

The DDTG monitor/debugger computer program was constructed for user and/or computer control of the Real Time Picture Processor (RTPP). The latter, a multiprocessor image acquisition/analysis system functions under DDTG in either stand-alone mode (direct user control) or is driven by one of several complex interpreter/model structures existing on a remote time shared PDP10 computer. In the latter case, the overall system, i.e. DDTG running on the RTPP, and driven by PDP10 structures, constitutes the CELMOD system. GRA

N76-33884# Bureau of Mines, Twin Cities, Minn. Mining Research Center.
A FORTRAN ROUTINE REORGANIZER
Marvin S. Seppanen Jan. 1976 66 p refs
(PB-250637/6; BM-IC-8696) Avail: NTIS HC $4.50 CSCL 09B

A computer program designed to aid the programer in making modifications to a FORTRAN routine that either he has not worked with for several months or he has never seen before by reorganizing FORTRAN routines was prepared. This reorganization includes: a sequential renumbering of the routine's statement numbers, a sequential renumbering and relocation of format statements, an alphanumberic reordering of dimensioned and typed variables, a uniform pattern of text spacing, and a sequential numbering of the records in the final FORTRAN routine. The computer program has been extensively tested and has proven to be a valuable tool for reorganizing FORTRAN routines. GRA

N76-33885# D. P. Management Corp., Lexington, Mass.
A COMPUTER MODEL TO DETERMINE LOW COST TECHNIQUES TO COMPLY WITH THE PRIVACY ACT OF 1974, USER'S GUIDE Final Report
Robert C. Goldstein and Henry H. Seward Feb. 1976 58 p ref
(Contract NBS-5-35935)

(PB-250755/6; NBS-DF-76/003; NBSIR-76-985) Avail: NTIS HC $4.50 CSCL 09B

The general system requirements for running the program, how to input information to the model, and how to interpret the output are described. The model accepts inputs about personal data systems, uses algorithms to provide incremental resources required to comply with the Privacy Act of 1974, and applies cost factors to the resources to provide a cost estimate. Cost estimates of alternative compliance techniques can be generated. These can later be compared by the user to determine a cost effective method of compliance. GRA

N76-33886# RAND Corp., Santa Monica, Calif.
SOFTWARE RELIABILITY: PHILOSOPHICAL UNDERPINNINGS
Robert C. Gammill Oct. 1974 22 p refs Presented at Intern. Conf. on Software Reliability, Los Angeles, 22-24 Apr. 1975
(AD-A019349; P-5306) Avail: NTIS CSCL 09/2

Reliability is a desirable trait in people, machines, software, and systems composed of them. However, it is only one of many traits which may be essential to satisfactory performance. An overemphasis upon reliability could necessitate a decrease in other desirable traits which may be more important in a specific situation. A personnel director told only to hire reliable people might hire people suited for work requiring trustworthiness, but completely unsuited for creative labor. Even with respect to reliability itself, careful distinctions must be made. The Nuremberg and Watergate trials delineate some differences between narrow and broad definitions of reliability. A reliable subordinate, in the sense of carrying out commands, may be extremely unreliable in a moral sense. Most definitions of reliable software seem to depend upon a narrow definition of reliability, which assumes that the commander is reliable, and so on back to the source of commands. Such an approach requires that the source be reliable in a broad sense. The world has ample evidence that such a definition is too narrow. GRA

N76-33887# Illinois Univ., Urbana. Coordinated Science Lab.
ON THE COMPLEXITY OF DECODERS FOR GOPPA CODES
Dilip V. Sarwate Feb. 1976 28 p refs
(Contract DAAB07-72-C-0259; Grant NSF GK-24879)
(AD-A023440; R-719; UILU-ENG-76-2207) Avail: NTIS CSCL 09/2

Sugiyama et al. have shown that, for a t-error-correcting Goppa code of block length n, the key equation for errors-only decoding as well as for errors-and-erasures decoding can be solved in O(t sq) arithmetic operations. Their algorithms use the extended version of Euclid's algorithm for the greatest common division (GCD) of two polynomials and have the same order of complexity as Berlekamp's algorithm for BCH codes. It is shown here that if a more efficient algorithm for computing polynomial GCDs is used, then the key equation can be solved in O(t log sq t) arithmetic operations. Also, determining the syndrome, the error locations and the error or erasure values all require O(n log n) arithmetic operations. Thus, for a fixed ratio of t/n, errors-only decoding as well as errors-and-erasures decoding of a Goppa code can be done in O(n log sq n) arithmetic operations. It is also shown that long primitive binary BCH codes can be decoded in O(n log n) arithmetic operations. Author (GRA)

N76-33888# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Advanced Sensors Directorate.
IN-HOUSE DEVELOPED SOFTWARE FOR RADIOMETRIC DATA REDUCTION AND ANALYSIS USING MICOM CDC 6600 COMPUTER
George L. Marshall, Jr. and Whitney J. Blanchard 15 Aug. 1975 87 p refs
(DA Proj. 1M3-63307-D-238)
(AD-A023618; RE-76-11) Avail: NTIS CSCL 17/5

A series of programs written in the FORTRAN language, and utilizing the DEC PDP-8 minicomputer and CDC 6600 computer, have been prepared for reducing the spectral circular variable filter obtained with two Electro-Optical Industries: radiometers in the 3 to 5 and 8 to 14-micrometer wavelength regions. The data reduction process is accomplished by means of three discrete programs: 1 raw data plotting; 2 CVF calibration curve determination; and 3 final data reduction using the results of (1) and (2). Flowcharts, theory, and complete listings are presented and output results for a sample case are included. Author (GRA)

N76-33889# National Bureau of Standards, Washington, D.C.
SOFTWARE EXCHANGE DIRECTORY FOR UNIVERSITY RESEARCH ADMINISTRATION Final Report, 1 Jul. 1974 - 31 Dec. 1975
Zella G. Ruthberg and Gloria R. Bolotsky Apr. 1976 217 p refs
(PB-253651/4; NBS-TN-916) Avail: NTIS HC $7.75 CSCL 09B

The one hundred universities and colleges receiving the largest Federal funding for research and development were sent an Office of Management and Budget (OMB) approved survey instrument. Seventy-five institutions sent responses suitable for 83 directory entries under administrative information and 315 directory entries under software package summaries. An administrative entry contains information on the reporting unit, the basic administrative structure and parameters, computer usage, automated functional areas, and comments. A package entry contains a functional description, software and hardware characteristics, history, availability and comments. GRA

N76-33890# Wisconsin Univ., Madison. Mathematics Research Center.
RATIONAL MIXED-INTEGER MINIMIZATION MODELS
R. R. Meyer and M. V. Thakkar Jan. 1976 29 p refs
(Contract DAAG29-75-C-0024; Grant NSF DCR-74-20584)
(AD-A022718; MRC-TSR-1552) Avail: NTIS CSCL 12/1

The concept of minimization model is defined, and its applications to nonlinear optimization are described. Necessary conditions and sufficient conditions are established for functions to have minimization models in the form of parametric mixed-integer programs with rational coefficients. These necessary conditions may also be thought of as properties of the optimal value functions of rational mixed-integer programs subject to certain RHS perturbations. Author (GRA)

N76-33891# Texas Univ., Austin. Center for Cybernetic Studies.
GOAL PROGRAMMING AND MULTIPLE OBJECTIVE OPTIMIZATIONS, PART 1
A. Charnes and W. W. Cooper Nov. 1975 53 p refs
(Contracts N00014-75-C-0569; N00014-75-C-0621; NR Proj. 047-021; NR Proj. 047-048)
(AD-A022691; CCS-250-Pt-1) Avail: NTIS CSCL 12/1

This is Part I of a survey of recent developments in goal programming and multiple objective optimizations. In this part, attention is directed to goal programming with emphasis on the authors' own work (with others) in a variety of applications. This includes goal and goal interval programming, as well as characterizations which make it possible to obtain alternate representations and explicit solutions from special structural properties. Possibilities for various goal functionals are explored and delineated. One class of examples is developed in detail and an algorithm is supplied which utilizes sequences of ordinary linear programming problems to solve certain nonlinear and non-convex problems involving maxims of ratios of linear forms. Author (GRA)

N76-33892# Naval Research Lab., Washington, D.C.
ABSTRACT TYPES DEFINED AS CLASSES OF VARIABLES Interim Report
D. L. Parnas, John E. Shore, and David M. Weiss 22 Apr. 1976 13 p refs
(NRL Proj. B02-36)
(AD-A024451; NRL-7998) Avail: NTIS CSCL 09/2

The concept of type has been used without a precise definition in discussions about programming languages for 20 years. Before the concept of user-defined data types was introduced, a definition was not necessary for discussions of specific programming languages. This report discusses a definition of type in which the concept of variable is considered primitive and types are defined as various equivalence classes of variables that may be legally and meaningfully substituted for one another in different contexts. Abstraction from the differences between two variables

is then achieved by allowing the substitution of one variable in an equivalence class for another within specified contexts such as parameter substitution, assignment, and data sharing. The user of a language with an abstraction facility based on the preceding idea is free to group variables into types in ways meaningful to him but must state the conditions under which members of a group are equivalent. Several kinds of types are proposed for inclusion in such a language. Some examples are types defined by identical externally visible behavior (equivalent specification), types whose members differ according to the value of one or more parameters, and types whose members have identical representations. The preceding approach to type definition has a strong effect on the possibilities for code sharing, data sharing, and parameter passing. New or unusual compiling techniques will probably be required to exploit these possibilities. Author (GRA)

N76-33893# Rice Univ., Houston, Tex. Aero-Astronautics Group.
RECENT ADVANCES IN GRADIENT ALGORITHMS FOR OPTIMAL CONTROL PROBLEMS Interim Report
A. Miele 1975 128 p refs
(Contract AF-AFOSR-2185-72; AF Proj. 9749)
(AD-A023036; AAR-129; AFOSR-76-0169TR) Avail: NTIS CSCL 12/1

This is a survey paper which summarizes recent advances in the area of gradient algorithms for optimal control problems, with particular emphasis on the work performed by the Aero-Astronautics Group of Rice University. The following topics are treated: sequential gradient-restoration algorithm, family of gradient-restoration algorithms, hybrid modification of the sequential gradient-restoration algorithm, sequential conjugate gradient-restoration algorithm, nondifferential constraints, multiple subarcs, and transformation techniques. Author (GRA)

N76-33894# George Washington Univ., Washington, D.C. Inst. for Management Science and Engineering.
SECOND-ORDER PARAMETRIC SENSITIVITY ANALYSIS IN NLP AND ESTIMATES BY PENALTY FUNCTION METHODS
Robert L. Armacost and Anthony V. Fiacco 4 Dec. 1975 59 p refs
(Contract DAHC04-74-C-0002)
(AD-A022629; Serial-T-324; ARO-11559.5-M) Avail: NTIS CSCL 12/2

Pursuing a number of theoretical results recently obtained by Fiacco, this paper continues the development of a basis for calculating first-order changes in a Kuhn-Tucker triple and second-order changes in the optimal value function of a class of general parametric nonlinear programming problems, with respect to a perturbation of the problem parameters. Exploiting problem structure, specific formulas are derived for calculating the first partial derivatives of a Kuhn-Tucker triple. Approximations to these quantities are obtained in parallel throughout, by way of an associated logarithmic-quadratic penalty function. Applications are indicated. GRA

N76-33895# Naval Air Development Center, Warminster, Pa. Aero-Electronic Technology Dept.
COMPUTER PROGRAMS FOR SCATTERING EFFECTS INVESTIGATION Interim Report
Robert D. Hayes 14 Apr. 1976 240 p refs
(AD-A024634) Avail: NTIS CSCL 09/5

To aid potential users of two computer antenna prediction programs, sample problems were developed and executed on a computer. For these programs, input load sheets, problem diagrams, program listing and output data are given. Author (GRA)

62 COMPUTER SYSTEMS

Includes computer networks.

N76-33896 Michigan Univ., Ann Arbor.
MESSAGE-SWITCHING PROTOCOLS IN DISTRIBUTED COMPUTER NETWORKS, VOLUMES 1 AND 2 Ph.D. Thesis
William Djohansjah Tajibnaps 1976 412 p
Avail: Univ. Microfilms Order No. 76-19254

The first and most important function that any computer network must perform is message-switching. The ideal message-switching protocol maximizes thruput, minimizes response time and adapts to changes in the topology of the network. A theoretical analysis is presented of some practical message-switching protocols for distributed computer networks, and of the support protocols that they need. A classification of message-switching protocols was developed: they can be divided into non-routing protocols, which do not make use of information about the network that can change (e.g., the topology of the network); and routing protocols, which do. Criteria for correctness of these protocols was also developed. The need for an acknowledgement protocol (which provides positive confirmation of message delivery) and for a sequence number maintenance protocol (which re-synchronizes sequence numbers when a node restarts) was shown, and various such protocols were analyzed and proved correct. Dissert. Abstr.

N76-33897# Rockwell International Corp., Anaheim, Calif. Autonetics Group.
REAL-TIME SECURITY ASSESSMENT WITH FAST OPTIMUM GENERATION SHIFT CONTROL
Samir A. Arafeh 31 Aug. 1976 12 p refs Proposed for presentation to the IEEE Winter Meeting, New York, Jan. 1977
(X76-952/801) Avail: NTIS HC $3.50

A software package for the network steady-state security assessment and control, developed for the real-time operation of a large-scale power system, is presented. The conditions checked are the circuit (line and/or transformer) overloads due to existing operating conditions or subject to potential single generator or circuit outage as well as multiple outages. The main features of this package, which is designed for 500 buses and 1000 circuits, are: (1) the processing of a large number of contingency checks (570 contingencies), (2) the high frequency of execution (every 15 minutes), (3) the reduced dependency on the integrity of the real-time data input, (4) the overload checking in terms of quantities related to the equipment's temperature limits, i.e., MVA or current values, and (5) the display of the overload conditions to the dispatcher along with the necessary remedial control action to alleviate or reduce these conditions. Author

N76-33898# Waterloo Univ. (Ontario). Dept. of Electrical Engineering.
ANALYSIS OF ERRORS IN PIECEWISE LINEAR NETWORK COMPUTATIONS
M. E. Zaghloul Oct. 1975 219 p refs
(Grant NRC-A-7113)
(UWEE/75-4) Avail: NTIS HC $7.75

Nonlinear networks in which the nonlinear element characteristics are approximated by continuous piecewise linear functions are considered. The network solution errors resulting from these approximations were studied first for nonlinear resistive networks and then for nonlinear dynamic networks. The measure of a matrix is used as a tool to compute bounds on these errors. These bounds are obtained both in terms of the properties of the original nonlinear network and of the properties of the approximating piecewise-linear network. The behavior of these bounds in terms of the network's physical properties is presented. Applications of these results to numerical examples of nonlinear networks and their approximating piecewise-linear counterparts are illustrated. In addition an alternative numerical method is introduced for computing, from the piecewise-linear solution, bounds on the regions in space where the exact solutions lie. A computer program for the case of resistive networks was developed and several numerical examples are presented. An extension to the dynamic networks is presented with some illustrative numerical examples. Author

N76-33899# Brookhaven National Lab., Upton, N.Y.
DESIGN AUTOMATION FOR ENTIRE DIGITAL SYSTEMS
A. M. Peskin Nov. 1975 21 p refs Presented at 9th Ann. Simulation Symp., Tampa, Fla., 17 Mar. 1976 Sponsored by ERDA
(BNL-20685; Conf-760320-1) Avail: NTIS HC $3.50

MODEL/LINDA is a unified logic design automation system centered around a base hardware description language called MODEL. This language and its simulator bear several important advantages in comparison to most predecessor logic design automation codes. Perhaps the most important of these is that it was designed for extensibility and, hence, was able to incorporate techniques for modeling many aspects of computer software as well as hardware. This made MODEL a very useful tool for analyzing and validating digital systems designs in their entirety. Author (ERA)

N76-33900# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
ACTIVITIES OF THE COMPUTER CENTER OF THE CNR RESEARCH DEPARTMENT IN FRASCATI Annual Report, 1974 [ATTIVITA DEL CENTRO DI CALCOLO DELL AREA DELLA RICERCA DEL C.N.R. DI FRASCATI NEL 1974]
G. Moreno and M. Sacchetti Jun. 1975 20 p refs In ITALIAN
(LPS-75-20) Avail: NTIS HC $3.50

Activities incorporating an IBM 370/125 are reported. They include space plasma research and work at the Laboratory of Space Astrophysics. Other computer time fractions were devoted to the organization of the library and to programs developed by CNEN scientists. ESA

N76-33901# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
THE NETWORKING OF INTERACTIVE BIBLIOGRAPHIC RETRIEVAL SYSTEMS Final Report, 15 Jul. 1974 - 31 Nov. 1975
Richard S. Marcus and J. Francis Reintjes Mar. 1976 174 p refs
(Grant NSF SIS-74-18165)
(PB-252407/2; ESL-R-656) Avail: NTIS HC $6.75 CSCL 09B

The concept of a virtual retrieval system was studied. Such a virtual system can be created through a translating computer interface that would provide access to the different retrieval systems and data bases in a uniform and convenient way, even for the inexperienced user. An experimental interface, called CONIT was built to test the virtual system concept. Initial evaluation of CONIT, which connects four retrieval systems, suggests that the virtual system approach could be cost effective. Particular attention was focused on the requirements for a common command language, ease of use, and message interpretation and protocols in a networked interface. GRA

N76-33902# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
AUTOMATIC DESIGN OF DATA PROCESSING SYSTEMS
Gregory R. Ruth Feb. 1976 32 p refs
(Contract N00014-75-C-0661)
(AD-A023451; TM-70) Avail: NTIS CSCL 09/2

The design of data organization and data accessing procedures for data processing systems operating on large keyed files of data is a common and recurrent activity in modern data processing applications. A considerable amount of understanding and expertise in this area has been developed and it is time to begin codifying and automating this process. It should be possible to develop a system where the user has merely to specify the characteristics of his data objects and their interrelations and the system will automatically determine the data organizations and accessing procedures that are optimal for his application. The optimizer for Protosystem I (an automatic programming system prototype at MIT) provides an example of how such automation can be accomplished. GRA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N76-33903# Waterloo Univ. (Ontario). Dept. of Electrical Engineering
LOW-SENSITIVITY DYNAMIC COMPENSATORS FOR LINEAR STOCHASTIC SYSTEMS WITH RANDOM PARAMETERS
V. H. Quintana Apr. 1976 22 p refs
(UWEE/76-2) Avail: NTIS HC $3.50

Procedures for the low-trajectory-sensitivity design of reduced-order output-feedback dynamic controllers for linear stochastic systems with zero-mean random variations of plant multiparameters are presented. Both the finite and infinite terminal time designs are discussed. Several special cases are considered, leading to simpler problem designs. Author

N76-33904*# Kanner (Leo) Associates, Redwood City, Calif.
THEORETICAL ISSUES OF AUTOMATA, ROBOTS AND DIGITAL COMPUTERS
Washington NASA Oct. 1976 82 p refs Transl. into ENGLISH of "Voprosy teorii avtomatov, robotov i TsVM", Cybernetics, Acad. Sci., Kiev, 1975 p 1-98
(Contract NASw-2790)
(NASA-TT-F-17219) Avail: NTIS HC $5.00 CSCL 09B

Theoretical and, primarily, computer modeling of various types of robots and robot subsystems is presented. Computer simulation of an 'eye-hand' type robot, problems of organization and simulation of robot stereovision systems, data presentation to the PPR-2 robot action planning system, the prototype TAIR autonomous transport robot, a system of presentation of knowledge for an integrated robot, goal orientation of a transport robot, organization of robot movement planning and experimental study of the model are discussed. Author

N76-33905# Kernforschungszentrum, Karlsruhe (West Germany).
ADAPTIVE PROCESS CONTROL WITH TREND MODEL
G. Schaffrath and M. Shahata Aug. 1975 136 p In GEORGIAN
(KFK-PDV-48) Avail: ERDA Depository Libraries HC $6.00

A universal model for adaptive control is described. The proposed trend model is a statistical description of rapidly varying processes which are otherwise difficult to describe. Signals from a plant in usual action, were used. The algorithms are formulated in a general way to be used for the identification of a system, as well as for its control. The conditions of real time action and the capabilities of process computers allow only for algorithms with restricted running time and core requirements. The described trend algorithms worked well under the conditions of several real applications. Author (ERA)

N76-33906# Florence Univ. (Italy). Facolta d'Ingegneria.
DATA STRUCTURES FOR THE INTERPRETATION OF LAMBDA EXPRESSIONS [STRUTTURE DI DATI RELATIVE ALL'INTERPRETAZIONE DI LAMBDA-ESPRESSIONI]
Gianni Aguzzi 1974 27 p refs In ITALIAN Presented at the Seminary of the Ist. di Mat. Appl., Florence, 30 Apr. 1974
Avail: NTIS HC $4.00

The problem of representation is considered from the point of view of defining an interpretive algorithm for lambda expressions. The definitions of lambda calculations are detailed together with calculus rules. The syntax and semantics for lambda calculations in abstract form are explained and examples given. ESA

N76-33907# Florence Univ. (Italy). Facolta d'Ingegneria.
FUNDAMENTALS OF INFORMATION THEORY [SUI FONDAMENTI DELLA TEORIA DELL INFORMAZIONE]
Giuseppe Longo (Trieste Univ.) 1975 22 p refs In ITALIAN Presented at the Seminary of the 1st Group of Ital. Seminaries and Math. Inst., Florence, 18 Apr. 1975
Avail: NTIS HC $3.50

The Shannon theory is reviewed with regard to the need to consider essentially the couples source-user with consequent need for some measurement of the usefulness of information. The theory of Kampe de Feriet and Forte is analyzed from an axiomatical point of view with regard to P-independency and J-independency leading to the notion of independence in the sense of set theory for which a number of definitions are given, and theorems are proved. ESA

N76-33908# Florence Univ. (Italy). Facolta d'Ingegneria.
CONTROLLABILITY PROBLEMS [PROBLEMI DI CONTROL-

LABILITA]
Roberto Conti 1974 13 p refs In ITALIAN Presented at the Seminary of the Ist. di Mat. Appl., Florence, 18 Jun. 1974
Avail: NTIS HC $3.50

Some aspects of the concept of control are studied from a mathematical point of view and exemplified for five selected problems. ESA

N76-33909# Florence Univ. (Italy). Facolta d'Ingegneria.
AXIOMATIC MATHEMATICAL THEORY OF INFORMATION [SU L'ASSIOMATICA DELLA TEORIA MATEMATICA DELLA INFORMAZIONE]
Ugo Barbuti 1975 25 p refs In ITALIAN Presented at the Seminary of the Ist. di Mat. Appl., Florence, 16 Apr. 1975
Avail: NTIS HC $3.50

A seminar on various possible axiomatizations of information theory is presented. Reviewing the theory of Kampe de Feriet and Forte it is shown that axioms may be defined for the concept of event uncertainty. The consequences are detailed. ESA

N76-33910# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
DESCRIPTION OF MULTIPARAMETER CONTROL PROPERTIES OF THE HUMAN VEHICLE CONTROLLER [BESCHREIBUNGSMOEGLICHKEITEN FUER DIE MEHRGROESSENREGELUNGSEIGENSCHAFTEN DES MENSCHEN BEI DER FAHRZEUGFUEHRUNG]
Dieter Dey and Uwe Kirchhoff 1975 138 p refs In GERMAN Sponsored by Fraunhofer-Ges. e. V.
(ILR-6; ISBN-3-7983-0547-1) Avail: NTIS HC $6.00

The Bolt, Beranek, and Newman model for description of human multiparameter control properties, was investigated from the viewpoint of anthropotechnology, mathematics and control technology. Aspects of modern control theory, such as optimal control optimal filtering, and optimal prediction, were used. Practical application of the model is demonstrated for two examples using a FORTRAN program developed for this purpose. ESA

N76-33911# Loughborough Univ. of Technology (England). Dept. of Mathematics.
CURRENT WORK ON STRUCTURAL PROBLEMS
A. C. Pugh Aug. 1975 18 p refs Presented at the Select Meeting on Composite Systems, Manchester, Engl.
(Grant SRC-B/SR/8561)
(MATHS-Res-72) Avail: NTIS HC $3.50

A review is presented of structural problems in systems theory, indicating some of the mathematical concepts involved. The type of systems studied can usually be associated with systems formed by the interconnection of several subsystems. A general theory of structural invariance is given, and a non-interacting control theory is described together with its extensions. Also, a hierarchical theory of systems is discussed. ESA

N76-33912# Loughborough Univ. of Technology (England). Dept. of Mathematics.
AN IMPROVED ALGORITHM FOR OPTIMAL STABILISATION OF LINEAR SYSTEMS
A. C. Pugh and A. K. Shelton Sep. 1975 9 p refs
(Grant SRC-B/SR/8561)
(MATHS-Res-78) Avail: NTIS HC $3.50

The algorithm proposed is based on the dyadic decomposition of the plant matrix. It is superior to others previously given. Author (ESA)

N76-33913# Loughborough Univ. of Technology (England). Dept. of Mathematics.
FRECHET DIFFERENTIABILITY AND OPTIMAL CONTROL
S. J. Leese Oct. 1975 26 p refs
(MATHS-Res-81) Avail: NTIS HC $4.50

It is shown that in the standard control problem the trajectory is, in general, a continuously Frechet differentiable function of control, the space of admissible control being given the uniform norm. A formula is given for the Frechet derivative. It follows from this that a general cost function on the system is a Frechet differentiable function of the control. As a preparation for work on numerical methods it is shown that the same things are true for neutral time-lag systems, and a formula is given for the derivative of the cost function. For simplicity and greater possible usefulness, the main results are stated and proved for piecewise continuous controls; it is shown how they may be extended to measurable controls, with essentially the same proofs. Another extension, to Banach space-valued controls and trajectories, is given. Author (ESA)

N76-33914# Loughborough Univ. of Technology (England). Dept. of Mathematics.
THE CONVERGENCE OF GRADIENT METHODS FOR OPTIMAL CONTROL PROBLEMS
S. J. Leese Oct. 1975 11 p refs Sponsored by Sci. Res. Council
(MATHS-Res-82) Avail: NTIS HC $3.50

A general convergence theorem for gradient algorithms in normed spaces is given and is applied to the unconstrained optimal control problem. A further application is given to time-lag systems of neutral type. Author (ESA)

N76-33915# Loughborough Univ. of Technology (England). Dept. of Mathematics.
OPTIMAL CONTROL WITH A STATE SPACE INEQUALITY CONSTRAINT: GRADIENT METHODS
M. A. Connor Dec. 1975 16 p refs
(MATHS-Res-86) Avail: NTIS HC $3.50

A new derivation of the Bryson-Denham modified gradient method for optimal control problems with a state space inequality constraint is presented with specific suggestions for the selection of the exit time from the constraint boundary. In addition, a new conjugate gradient method for the solution of state constrained problems is proposed. The derivation of the Bryson-Denham algorithm presented can, under suitable assumptions, be extended to delay systems, and this is considered the main advantage when compared with the original derivation. Author (ESA)

N76-33916# Loughborough Univ. of Technology (England). Dept. of Mathematics.
A NEW AUGMENTED PENALTY FUNCTION TECHNIQUE FOR OPTIMAL CONTROL FUNCTIONS
M. A. Connor and M. Vlach (Charles Univ., Prague) Jan. 1976 19 p refs
(MATHS-Res-89) Avail: NTIS HC $3.50

An extension of the Miele-Cragg-Iyer-Levy augmented function method is presented for finite dimensional optimization problems to optimal control problems with terminal constrants. A numerical study demonstrates some of its features. Special cases give the results obtained by Miele at al, for the mathematical programming problem. It is important to recognize that the proposed method is not restricted to any particular gradient algorithm, and further work is in progress to investigate conjugate gradient methods. Author (ESA)

N76-33917# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
OPTIMAL LINEAR CONTROL FORMULATION TO MEET CONVENTIONAL DESIGN (SPECS) Technical Report, 1 Dec. 1974 - 1 Dec. 1975
G. L. Hartmann, C. A. Harvey, and C. E. Mueller 29 Mar. 1976 91 p refs
(Contract N00014-75-C-0144)
(AD-A023117; HONEYWELL-76-SRC/5; TR-1) Avail: NTIS CSCL 12/1

This report contains results of initial research into the advancement of optimal linear control design technology to the state where operational control laws can be designed routinely with automated quadratic optimal design procedures. The specific results documented in this report consist of design rules for single-input systems, demonstration of these rules on two authentic examples, and identification of the independent optimization parameters for multiple-input systems. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N76-33918# Waterloo Univ. (Ontario). Solid Mechanics Div.
ON EXTENSION OF STEKLOV'S INEQUALITY AND A LOWER BOUND THEOREM FOR PFLUEGER'S ROD
H. H. E. Leipholz Dec. 1975 20 p refs Presented to the 8th Southeastern Conf. on Theoretical and Applied Mechanics, Blacksburg, Va., 19 Nov. 1975
(Paper-136; ISSN-0317-7130) Avail: NTIS HC $3.50

An integral inequality is derived using a generalized Rayleigh quotient existing for a certain class of nonselfadjoint boundary value problems. This inequality comprises Steklov's inequality as a special case. In a version which allows a relaxation of the boundary conditions, the inequality is used for the calculation of a lower bound of the first buckling loads of Pflueger's rod.
Author

N76-33919# Sandia Labs., Albuquerque, N.Mex.
HIGH-SPEED DIGITAL FILTERS USING RESIDUE NUMBER ARITHMETIC
M. A. Soderstrand 1975 5 p refs Presented at 9th Ann. Asilomar Conf. on Circuits, Systems and Computers, Pacific Grove, Calif., 3 Nov. 1975 Sponsored by ERDA
(SAND-75-8742; Conf-751109-3) Avail: NTIS HC $4.50

A technique is described for implementing digital filters using residue number arithmetic. Recursive, as well as non-recursive, digital filters may be realized since the required multiplication by a fraction is accomplished by using table look-up methods rather than the slower residue technique. The resulting circuit is an economical high speed digital filter structure which is suitable either for implementation using commercially available components, or for mass production of digital filters for the consumer.
Author (ERA)

N76-33920# Sandia Labs., Albuquerque, N.Mex.
PROCEDURE TO PRODUCE ERROR ESTIMATES FOR DIFFERENCE APPROXIMATIONS TO DIFFERENTIAL EQUATIONS. 1: INTRODUCTION AND ILLUSTRATION OF THE BASIC CONCEPT
D. L. Hicks Jan. 1976 28 p refs
(Contract AT(29-1)-789)
(SAND-75-0487) Avail: NTIS HC $5.00

By embedding discrete difference equations into continuum difference equations and taking the derivative with respect to the mesh size, a differential difference equation is generated. The solution of this differential-difference equation is used to estimate the distance between the solution of the difference equation and the limit solution as the mesh size goes to zero. This method provides a general procedure for producing an estimate of the error made in approximating a solution to a differential equation with a solution of a difference equation.
Author (ERA)

N76-33921# California Univ., Livermore. Lawrence Livermore Lab.
GENERALIZED CONJUGATE GRADIENT METHOD FOR NONSYMMETRIC SYSTEMS OF LINEAR EQUATIONS
P. Concus and G. H. Golub (Stanford Univ., Calif.) Dec. 1975 12 p refs Presented at 2d Intern. Symp. on Computing Methods in Applied Sci. and Engr., Versailles, France, 15 Dec. 1975
(Contract W-7405-eng-48)
(LBL-4636; Conf-751230; SU-STAN-CS-75-535) Avail: NTIS HC $3.50

A generalized conjugate gradient method is considered for solving systems of linear equations having nonsymmetric coefficient matrices with positive-definite symmetric part. The method is based on splitting the matrix into its symmetric and skew-symmetric parts, and then accelerating the associated iteration by using conjugate gradients; the method simplifies in this case, as only one of the two usual parameters is required. The method is most effective for cases in which the symmetric part of the matrix corresponds to an easily solvable system of equations. Convergence properties are discussed, as well as an application to the numerical solution of elliptic partial differential equations.
ERA

N76-33922# Naples Univ. (Italy). Istituto di Aerodinamica.
FUNCTIONAL ANALYSIS APPROACH FOR THE DERIVATION OF HYBRID VARIATIONAL FUNCTIONALS
L. G. Napolitano Sep. 1975 11 p refs Presented at IUTAM/IUM Symp. on Appl. of Methods of Functional Analysis to Probl. of Mech., Marseille, Sep. 1975 p 1-8
(Grant AF-AFOSR-2704-74; AF Proj. 9781)
(AD-A023432; AFOSR-76-0358TR) Avail: NTIS CSCL 20/4

The original boundary value problem is embedded in a larger class of b.v. problem pertaining to physical quantities of tensorial order higher than that of the original problem. The new b.v. problem is interpreted as defining an isomorphism between two appropriate Hilbert spaces; the constraint space and the solution space H, the unique solution of the original b.v. problem being thus characterized as the unique element of H satisfying a prescribed set of constraints. Then variational formulations are deduced by: (1) defining subsets of H satisfying an arbitrary number of such constraints (thus generalizing the notions of 'equilibrating' and 'compatible' solutions) (2) characterizing the solution vector as the unique element common to two such subsets and (3) finding the appropriate functional, defined over these two subsets, which is rendered stationary (in particular minimum) by the exact solution.
GRA

N76-33923# Sydney Univ. (Australia). Civil Engineering Labs.
THE NUMERICAL SOLUTION OF VISCO-ELASTIC PROBLEMS USING LAPLACE TRANSFORMS
J. R. Booker and J. C. Small Sep. 1975 21 p refs
(PB-251363/8; R-272) Avail: NTIS HC $3.50 CSCL 20L

Linear visco elastic problems are converted to an equivalent problem by means of a Laplace transformation. The problem is approximated in Laplace transform space and a numerical solution found by finite element techniques. This solution is then transformed back to obtain a numerical solution of the original problem. The solution is found in the form of an eigenvalue expansion, this form of solution being particularly convenient in that the same solution can be used to predict the behavior corresponding to any chosen viscoelastic material.
GRA

N76-33924# Wisconsin Univ., Madison. Mathematics Research Center.
GENERALIZED BOUNDARY VALUE PROBLEMS AND B-SPLINES Technical Summary Report
R. C. Brown Jan. 1976 46 p refs
(Contract DAAG29-75-C-0024; Grant NSF GP-40381)
(AD-A022717; MRC-TSR-1418) Avail: NTIS CSCL 12/1

The existence of two types of local support bases is investigated and a Curry-Schoenberg type basis theorem is proven for classes of splines viewed as orthogonal complements of the ranges of certain minimal operators determined by Stieltjes side conditions. The theory is illustrated by several examples.
Author (GRA)

N76-33925# Wisconsin Univ., Madison. Mathematics Research Center.
REGULARITY AND STABILITY FOR CONVEX MULTIVALUED FUNCTIONS Technical Summary Report
Stephen M. Robinson Jan. 1976 36 p refs
(Contract DAAG29-75-C-0024; Grant NSF DCR-74-20584)
(AD-A022719; MRC-TSR-1553) Avail: NTIS CSCL 12/1

Multivalued functions with convex graphs are shown to exhibit certain desirable regularity properties when their ranges have internal points. These properties are applied to develop a perturbation theory for convex inequalities, and to extend results on the continuity of convex functions.
Author (GRA)

N76-33926# RAND Corp., Santa Monica, Calif.
INVARIANT IMBEDDING AND THE SOLUTION OF FREDHOLM INTEGRAL EQUATIONS WITH DISPLACEMENT KERNELS: COMPARATIVE NUMERICAL EXPERIMENTS
M. A. Cali, J. Casti, and M. L. Juncosa May 1975 13 p refs
(AD-A022168; P-5427) Avail: NTIS CSCL 12/1

Some recent literature has dealt with problems of numerical solution of certain types of Fredholm integral equations by

replacing them with initial value problems for a system of ordinary differential equations which also contain integrals of the unknown functions with respect to a parameter (method of invariant imbedding). However, no experiments have heretofore been carried out to test the relative efficiencies of the invariant imbedding method vis-a-vis traditional solution techniques. In this paper the results of such a numerical experiment are described. The experiment consists of comparing the methods of invariant imbedding, successive approximations (Picard method), linear algebraic equations, and Sokolov's method of averaging functional corrections to solve numerically two representatives of a class of Fredholm integral equations. GRA

N76-33927# Wisconsin Univ., Madison. Mathematics Research Center.
AN L2-THEORY OF DUAL INTEGRAL EQUATIONS
R. P. Srivastav Feb. 1976 37 p refs
(Contract DAAG29-75-C-0024)
(AD-A023977; MRC-TSR-1449) Avail: NTIS CSCL 20/11

Dual integral equations with different types of kernels arise in the mixed boundary value problems of the mathematical theory of elasticity. A unified theory for the equations, whose solutions are square integrable functions, is developed in this paper. The solution is determined as the intersection of two linear manifolds in a Hilbert space. The theory is illustrated by a few simple examples. GRA

N76-33928# Rock Island Arsenal, Ill. General Thomas J. Rodman Lab.
THREE DEFINITIONS OF BEST LINEAR APPROXIMATION Final Report
James J. Hurt 1 Apr. 1976 32 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A023501; RIA-R-TR-76-011) Avail: NTIS CSCL 12/1

Three definitions of best (in the least squares sense) linear approximation to given data points are presented. The relationships between these three are discussed along with their relationship to basic statistics such as mean values, the covariance matrix, and the (linear) correlation coefficient. For each of the three definitions, the best line is solved in closed form in terms of the data centroid and the covariance matrix. GRA

N76-33929# Ohio State Univ., Columbus. Dept. of Geodetic Science.
INTEGRAL FORMULAS AND COLLOCATION
Helmut Moritz Dec. 1975 69 p refs
(Contract F19628-76-C-0010; AF Proj. 7600)
(AD-A022976; DGS-234; AFCRL-TR-75-0628; SR-1) Avail: NTIS CSCL 12/1

The report deals with various theoretical and numerical aspects of the interplay between least-squares collocation and classical integral formulas. It is proved that geodetic integral formulas may be considered as limiting cases of collocation for homogeneous and regularly and densely distributed data. Collocation methods can be employed for adjusting continuous data and combining them with other measurements, before using them with integral formulas. With respect to numerical computation, integral formulas and collocation techniques mutually complement each other, which is most convenient for the solution of many practical problems. Author (GRA)

N76-33930# Missouri Univ., Columbia. Dept. of Mathematics.
ORDINARY DIFFERENTIAL EQUATIONS: STABILITY AND VARIATIONAL THEORY Final Report, 26 Sep. 1967 - 31 Dec. 1975
Walter Leighton 5 Mar. 1976 25 p refs
(Contract DAHC04-68-C-0007; Grant
DA-ARO(D)-31-124-G979)
(AD-A022610; ARO-7593.24-M) Avail: NTIS CSCL 12/1

Oscillation theory of self-adjoint linear differential equations of second order is the major topic, but two papers are concerned with oscillation theory of self-adjoint differential equations of fourth order. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N76-33931# California Univ., Livermore. Lawrence Livermore Lab.
MONTE CARLO APPROACH TO NUMERICAL DECONVOLUTION
M. P. Ekstrom 6 Jan. 1976 6 p refs Presented at IEEE Intern. Conf. on Acoustics, Speech and Signal Processing, Philadelphia, 12 Apr. 1976
(Contract W-7405-eng-48)
(UCRL-77353; Conf-760413-1) Avail: NTIS HC $3.50

A numerical procedure for solving deconvolution problems is presented. The procedure is based on the Monte Carlo method, which statistically estimates each element in the deconvolved excitation. A discrete Fourier transform technique is used to improve the quality of these estimates for a prescribed amount of computation. Author (ERA)

N76-33932# Florence Univ. (Italy). Ist. di Ingegneria Civile.
PROBABILISTIC METHODS IN STRUCTURAL ENGINEERING: TENDENCIES AND PROSPECTS [METODI PROBABILISTICI NELL INGEGNERIA STRUTTURALE: TENDENZE E PROSPETTIVE]
Giuliano Augusti 1974 55 p refs In ITALIAN Presented at the CNR Ann. Meeting, Florence, 29-30 Nov. 1974
(UFIST/05/1974) Avail: NTIS HC $4.50

The methods of probability are applied to civil and structural engineering. The aims of probabilistic approaches are determined with a discussion on a priori, a posteriori probabilities and Bayes theorem. The notions of risk and safety in structural engineering are detailed together with operational methodologies with regard to purely probabilistic, semiprobabilistic, and Monte Carlo methods. The application to normative techniques is developed. The relation between probabilistic models and statistics is emphasized with application to structural resistance and loads. ESA

N76-33933# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
VARIANCE MATRIX METHOD AND ITS SIGNIFICANCE
Bruno Bavassano Oct. 1974 12 p refs
(LPS-74-25) Avail: NTIS HC $3.50

The variance matrix technique is considered and its applications in analyzing satellite data are shown. Criteria to evaluate the significance of a result are given. Author (ESA)

N76-33934# Loughborough Univ. of Technology (England). Dept. of Mathematics.
SMALL SAMPLE PERCENTAGE POINTS OF THE ANDERSON-DARLING STATISTIC FOR TESTING NORMALITY
A. N. Pettitt Jul. 1975 17 p refs
(MATHS-Res-71) Avail: NTIS HC $3.50

The Anderson-Darling goodness-of-fit statistic has been shown to be a powerful omnibus test of normality when the mean and variance are unknown. Small sample percentage points of the statistic are tabulated. The percentage points are derived from smoothing empirical percentage points using the asymptotic percentage points, and estimates of their accuracy are given. Also, the joint assessment of normality of several independent samples is discussed. Author (ESA)

N76-33935# Loughborough Univ. of Technology (England). Dept. of Mathematics.
PROPERTIES OF A CRAMER-VON MISES TYPE GOODNESS-OF-FIT STATISTIC RELATED TO SQUARE ROOT OF (B1) AND B2
A. N. Pettitt Dec. 1975 25 p refs
(MATHS-Res-84) Avail: NTIS HC $3.50

A statistic introduced by De Wet and Venter to test for normality was investigated. By studying a Cramer-von Mises type statistic closely related to the statistic of De Wet and Venter, it is shown that this statistic can be written as the sum of components, the most important of which are Pearson's moment ratio statistics other square root of (b1) and b2. Author (ESA)

N76-33936# California Univ., Los Angeles. Graduate School of Management.
EVALUATION OF NETWORK SERVICES
Bennet P. Lientz Feb. 1976 11 p refs
(Contract N00014-75-C-0266; NR Proj. 049-345)
(AD-A022201) Avail: NTIS CSCL 12/1

A major problem involved in network services is that of deciding upon criteria and timing for moving between one network and another. A particular case is that dealing with timesharing service facilities. The approach here is to isolate some of the elements of costs and benefits and then propose a stochastic process model for use in decision making. Implementation is also discussed. GRA

N76-33937# Center for Naval Analyses, Arlington, Va. Systems Evaluation Group.
RANDOM WALK FOR TARGET TRACKING
Peter J. Butterfly Sep. 1975 29 p refs
(Contract N00014-76-C-0001)
(AD-A019102; CRC-287) Avail: NTIS CSCL 12/1

Knowledge of the position of a mobile target must often be ascertained from knowledge of the position at an earlier time and a model of the target motion. The models considered in this research contribution are based on random walk theory and are applicable where the motion is of a complex, time-varying character. Differences in the initial conditions assumed and minor variations in the model account for the different sections. In each case, density and distribution functions are derived for the coordinates of the target. GRA

N76-33938# Illinois Univ., Urbana. Coordinated Science Lab.
ONE-DIMENSIONAL RANDOM WALKS OF LINEAR CLUSTERS
David A. Reed and Gert Ehrlich Feb. 1976 44 p refs
(Contract DAAB07-72-C-0259; Grant NSF DMR-72-02937)
(AD-A023439; R-718; UILU-ENG-76-2206) Avail: NTIS CSCL 12/1

A stochastic formalism is developed for the one-dimensional surface diffusion of atom clusters, with component atoms located in adjacent channels, by representing the diffusion as a random walk of the center of mass (COM). Relations between the mean square displacement of the center of mass and the rate constants characterizing COM motion are derived for dimers and trimers, starting from the Kolmogorov equation. For dimers in the limit of long diffusion intervals, COM rate constants and individual atomic jump rates can be deduced knowing the mean square displacement and the frequency of occurrence of different dimer configurations. This analysis is feasible for trimers only under special conditions; even then, separation into the individual atomic rate processes is not generally possible. Author (GRA)

N76-33939# Illinois Univ., Urbana. Coordinated Science Lab.
VARIABLE RATE SOURCE CODING M.S. Thesis
Kenneth Marsh Mackenthun, Jr. Dec. 1975 67 p refs
(Contract DAAB07-72-C-0259)
(AD-A023444; R-710; UILU-ENG-75-2246) Avail: NTIS CSCL 12/1

The chief result of this thesis is an extension of the variable rate source coding theorem for a family of ergodic sources. Some aspects of the continuity of the rate-distortion function are also discussed, an OPTA function for variable rate source codes is defined and some properties are given. In any rigorous presentation of work in rate-distortion theory, it is necessary to consider a precise description of the stationary source. The following section presents a brief mathematical description of the stationary source. Author (GRA)

N76-33940# Syracuse Univ., N.Y. Dept. of Industrial Engineering and Operations Research.
COMPOSITIONS, INVERSES AND THINNINGS OF RANDOM MEASURES Interim Report
Richard F. Serfozo Dec. 1975 27 p refs
(Grant AF-AFOSR-2627-74; NSF ENG-75-13653; AF Proj. 9769)
(AD-A023051; AFOSR-76-0287TR) Avail: NTIS CSCL 12/1

Compositions and inverses of measures on the real line are defined as measures whose cumulative distribution functions (c.d.f.'s) are compositions and inverses, respectively, of the c.d.f.'s of the measures involved. We study the continuity of the composition and inverse operators on measures. We then show how a large class of thinnings of point processes and random measures can be characterized by compositions of random measures. We present several convergence theorems for such compositions. These contain, as special cases, the classical thinning theorem of Renyi and many of its contemporary extensions. Author (GRA)

N76-33941# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
DESIGN FOR NASS: A NATIONAL ACCIDENT SAMPLING SYSTEM. VOLUME 1: TEXT Final Report, Jun. 1974 - Jul. 1975
J. ODay, A. Wolfe, and R. Kaplan May 1976 162 p
(Contract DOT-HS-4-00890)
(PB-254038/3; UM-HSRI-SA-75-14-1-Vol-1;
DOT-HS-801-913) Avail: NTIS HC $6.75 CSCL 13L

A design is presented for a national accident investigation program based on sampling theory. By limiting the number of investigations within a strict sampling plan it is possible to record sufficient detail about each accident to produce national estimates of injury, property damage, and other accident characteristics which will be useful in cost benefit analyses. The system described has three major facets: a program for continuous acquisition of data of a random sample of all towaway-pedestrian-bicycle-motorcycle accidents occurring in the U.S., a program for occasional acquisition of additional data on selected topics quickly and on-call, and a program for conducting in-depth or multidisciplinary accident investigations for accidents of particular interest. GRA

N76-33942# Wisconsin Univ., Madison. Mathematics Research Center.
STATISTICAL INFERENCE CONCERNING SOME COMPOUND AND GENERALIZED DISCRETE DISTRIBUTIONS Technical Summary Report
Narayan Rangnath Bhalerao and John Gurland Jan. 1976 183 p refs
(Contract DAAG29-75-C-0024)
(AD-A024077; MRC-TSR-1611) Avail: NTIS CSCL 12/1

Some compound and generalized Poisson distributions are investigated. Estimators of parameters in these families using various procedures based on generalized minimum chi-square are obtained, and their asymptotic relative efficiencies are compared. Tests of goodness of fit and of various linear hypotheses are also obtained. Iterative maximum likelihood algorithms for obtaining estimators in some compound power series distributions are also developed. Some results for the fitting of data using classical discrete orthogonal polynomials are also presented, based on generalized minimum Chi-square. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N76-33943# Loughborough Univ. of Technology (England). Dept. of Mathematics.
THE MCMILLAN DEGREE OF A POLYNOMIAL SYSTEM MATRIX
A. C. Pugh Aug. 1975 14 p refs
(Grant SRC-B/SR/8561)
(MATHS-Res-73) Avail: NTIS HC $3.50

The degree of a polynomial system matrix is introduced and is shown to possess certain invariance properties. Its interpretation in terms of the initial conditions is given and its relationship with the previously defined complexity is noted. Author (ESA)

N76-33944# Loughborough Univ. of Technology (England). Dept. of Mathematics.
A GRADIENT METHOD FOR NEUTRAL SYSTEMS
M. A. Connor and S. J. Leese Aug. 1975 25 p refs
(MATHS-Res-74) Avail: NTIS HC $3.50

A gradient method suitable for neutral systems with terminal equality constraints is presented, and its convergence

properties demonstrated by application to some examples. The method may easily be modified to a form comparable to the Polak-Ribiere algorithm for the case without terminal constraints, by using the same gradient derived in this work.
Author (ESA)

N76-33945# National Bureau of Standards, Washington, D.C.
GUIDELINES FOR DOCUMENTATION OF COMPUTER PROGRAMS AND AUTOMATED DATA SYSTEMS
Beatrice Marron 15 Feb. 1976 54 p
(PB-250867/9; FIPS-PUB-38) Avail: NTIS HC $4.50 CSCL 09B

A basis for determining the content and extent of documentation for computer programs and automated data systems is provided. Software development phases and related document types are identified, several examples of documentation options are given, and content guidelines for ten document types are provided. The document types are: functional requirements document; data requirements document; system/subsystem specification; program specifications; data base specification; users manuals; operations manual; program maintenance manual; test plan; and test analysis report. The guidelines are intended to be a basic reference and a checklist for general use throughout the Federal Government to plan and evaluate documentation practices.
GRA

N76-33946# Georgia Inst. of Tech., Atlanta. School of Industrial and Systems Engineering.
A METHODOLOGY TO ESTABLISH THE CRITICALITY OF ATTRIBUTES IN OPERATIONAL TESTS M.S. Thesis
Gary Steven Williams Oct. 1975 111 p refs
(Contract DAAG39-75-C-0095)
(AD-A024199) Avail: NTIS CSCL 15/5

Operational testing is an integral part of the materiel acquisition cycle in the Army procurement process. It is oriented towards the evaluation of a developmental item under realistic conditions as part of an actual troop unit. The test design phase is an essential element of operational testing. In order to facilitate the selection of measures of effectiveness used in these tests, the critical attributes which 'best' discriminate between acceptable and unacceptable systems or subsystems need to be identified. This thesis addresses a method which provides a basis for the selection of these critical attributes. Once these attributes are identified, the test designers of subsequent operational tests may use this information to assist them in the test design phase.
GRA

N76-33947# Georgia Inst. of Tech., Atlanta. School of Industry and Systems Engineering.
AN APPLICATION OF MULTIVARIATE DISCRIMINANT ANALYSIS AND CLASSIFICATION PROCEDURES TO RISK ASSESSMENT IN OPERATIONAL TESTING M.S. Thesis
Edward Dewey Simms, Jr. Jun. 1975 134 p refs
(Contract DAAG39-75-C-0097)
(AD-A024198) Avail: NTIS CSCL 15/5

A methodology which determines an index used in the assessment of risk in operational testing was developed. The risk assessment problem examined is that of prefefence statements regarding competing systems. In order to evaluate the competing systems, a multivariate statistical analysis of the systems is undertaken. Through the analysis of the multivariate distributions of each system and the overlap of these distributions, the index of risk is determined. Thus the index of risk is a measure of similarity of the competing systems.
GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N76-33948# Institutul de Fizica Atomica, Bucharest (Romania).
REDUCTION THEORY
S. Teleman 1975 32 p refs
(IFA-FA-1-1975) Avail: ERDA Depository Libraries HC $4.00

Some fields of Hilbert spaces, which were very close to the integrable fields are defined, but the second condition in that definition was satisfied only in a weakened form. It is shown that, by using W. Wils' central measures instead of the Choquet-Bisop-de Leeuw maximal measures, a similar theory is obtained which, compared with the previous one, has the advantage of providing integrable fields of Hilbert spaces. ERA

N76-33949# Loughborough Univ. of Technology (England). Dept. of Mathematics.
A NOTE ON THE CONTROLLABILITY OF LINEAR SYSTEMS IN HILBERT SPACE
J. Kyle Sep. 1975 8 p ref
(MATHS-Res-76) Avail: NTIS HC $3.50

Theorems are developed to denote the controllability of linear systems in a Hilbert space.
ESA

N76-33950# Loughborough Univ. of Technology (England). Dept. of Mathematics.
MEASURABLE SELECTIONS AND THE UNIFORMISATION OF ANALYTIC SETS
S. J. Leese Sep. 1975 11 p refs
(MATHS-Res-80) Avail: NTIS HC $3.50

Suppose that S, X are topological spaces and that A is an analytic subset of S x X; that is, A is the image of a Polish space under a semicontinuous compact valued mapping. It is shown that, if certain conditions are satisfied, there is a function gamma: pi sub S (A) yields X, which is measurable for a wide class of measures on S such that (t, gamma (t)) included in A for each t.
ESA

N76-33951# Loughborough Univ. of Technology (England). Dept. of Mathematics.
PROJECTIONS OF MEASURABLE AND SOUSLIN SETS
S. J. Leese Oct. 1975 10 p refs Sponsored by Sci. Res. Council
(MATHS-Res-83) Avail: NTIS HC $3.50

Sufficient conditions are given for a subset of a product space S x X to have a measurable or Souslin projection on S. The space X is a topological space and it is not in general assumed to be separable.
Author (ESA)

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N76-33952*# Scientific Translation Service, Santa Barbara, Calif.
ESTIMATION OF THE ACTION OF PERTURBING MOMENTS ON THE ACCURACY OF ROTATION STABILIZATION
V. B. Zhuravlev and M. Ya. Natenzon Washington NASA Oct. 1976 19 p refs Transl. into ENGLISH of Report Pr-264, Academy of Sciences USSR, Institute of Space Research, Moscow, 1976 p 1-17
(Contract NASw-2791)
(NASA-TT-F-17272) Avail: NTIS HC $3.50 CSCL 20K

The problem of determining the orientation of a body rotating around a center of mass under the action of a perturbation which is constant in a body-fixed coordinate system was formulated and solved.
Author

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N76-33953*# Kanner (Leo) Associates, Redwood City, Calif.
ACOUSTIC MEASUREMENTS ON VORTEX STREETS BEHIND CIRCULAR CYLINDERS AND FLAT PLATES
Richard Lehnert Washington NASA Oct. 1976 48 p refs Transl. into ENGLISH from Physikalische Zeitschrifte, v. 38, 1937 p 476-498
(Contract NAS2-2790)
(NASA-TT-F-17276) Avail: NTIS HC $4.00 CSCL 20A

Vortex frequencies and distances between successive vortices

were measured behind circular cylinders and flat plates exposed to a flow at different angles of incidence. Resonance detection and pitot tube listening were the two methods used for frequency determination. It is found that the dimensionless vortex frequency UND is a function of the Reynolds number, as is also the resistance coefficient. Vortex frequency and distance between vortices are functions of the distance behind the plate. Author

N76-33954*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTER METHOD FOR DESIGN OF ACOUSTIC LINERS FOR TURBOFAN ENGINES
Gene L. Minner and Edward J. Rice Washington Oct. 1976 93 p refs
(NASA-TM-X-3317; E-8428) Avail: NTIS HC $5.00 CSCL 20A

A design package is presented for the specification of acoustic liners for turbofans. An estimate of the noise generation was made based on modifications of existing noise correlations, for which the inputs are basic fan aerodynamic design variables. The method does not predict multiple pure tones. A target attenuation spectrum was calculated which was the difference between the estimated generation spectrum and a flat annoyance-weighted goal attenuated spectrum. The target spectrum was combined with a knowledge of acoustic liner performance as a function of the liner design variables to specify the acoustic design. The liner design method at present is limited to annular duct configurations. The detailed structure of the liner was specified by combining the required impedance (which is a result of the previous step) with a mathematical model relating impedance to the detailed structure. The design procedure was developed for a liner constructed of perforated sheet placed over honeycomb backing cavities. A sample calculation was carried through in order to demonstrate the design procedure, and experimental results presented show good agreement with the calculated results of the method. Author

N76-33955# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. fuer Turbulenzforschung.
THE INFLUENCE OF VISCOSITY OF THE WORKING FLUID ON THE SOUND PRODUCTION OF CENTRIFUGAL FANS
Manfred Bartenwerfer and Reuben Agnon 18 May 1976 23 p refs In GERMAN; ENGLISH summary Prepared jointly with Tech. Univ. Berlin
(DLR-FB-76-30) Avail: NTIS HC $3.50; DFVLR, Cologne DM 10.40

The influence of working fluid viscosity on the sound production of centrifugal fans was experimentally studied using a model fan with backward curved blades. The Reynolds number based on tip speed and diameter of the impeller varied over a range of Reynolds numbers by changing the air density at a constant temperature. Measurements of the harmonic and the random noise components are made at several points in the acoustic near field as well as in the far field. The results show that the sound production depends on the Reynolds number only for Re less than 100,000, while for Re greater than 100,000 the influence of the Reynolds number is negligible compared with the influence of other parameters. This is presumed to be true for all centrifugal fans. Author (ESA)

N76-33956# Lehigh Univ., Bethlehem, Pa.
LARGE AMPLITUDE WAVES IN BOUNDED AND STRATIFIED MEDIA Final Report, Jun. 1971 - Oct. 1975
E. Varley Feb. 1976 13 p refs
(Contract DAAD05-71-C-0389)
(AD-A021517/8; BRL-CR-286) Avail: NTIS HC $3.50 CSCL 20/1

Deformation that is produced when a large amplitude, but shockless, pulse traveling through an elastic material arrives at an interface with another elastic material is studied. The pulse propagates in a direction normal to the interface. The ideas of nonlinear impedance, reflection coefficient and transmission coefficient for such an interface were introduced. These were used to determine the amplitudes of the reflected and transmitted pulses in terms of that of the incident pulse. A detailed account was given of the deformation produced in an elastic slab when one boundary is impulsively loaded while the other radiates energy to an adjacent material. GRA

N76-33957# Naval Air Engineering Center, Lakehurst, N.J. Ground Support Equipment Dept.
EXPERIMENTAL EVALUATION OF NAS MIRAMAR HUSH HOUSE (PROJECT P-114), VOLUME 1 Final Report
W. P. Sule and E. T. Pulcher Feb. 1976 148 p refs
(AD-A024403; NAEC-GSED-96-Vol-1) Avail: NTIS CSCL 20/1

This report summarizes the results of an extensive experimental test and evaluation of the new NAS Miramar Hush House. The tests consisted of both aero-thermodynamic and acoustic data acquisition. Four different aircraft (A-4, F-8, F-4, F-14) were run in the facility, and acoustic data were obtained on two of the aircraft (F-4, F-14). The results of the full size testing were compared with 1/15th scale model test results to estimate the reliability of scale model tests for this application. Author (GRA)

N76-33958# Naval Air Engineering Center, Lakehurst, N.J. Ground Support Equipment Dept.
EXPERIMENTAL EVALUATION OF NAS MIRAMAR HUSH HOUSE (PROJECT P-114), VOLUME 2
W. P. Sule and E. T. Pulcher Feb. 1976 389 p
(AD-A024404; NAEC-GSED-96-Vol-2) Avail: NTIS CSCL 20/1

Tables are presented showing third octave sound pressure levels at 250 ft for F-4 and F-14 aircraft tested in various positions. A.R.H.

N76-33959# Syracuse Univ., N.Y. Dept. of Mechanical and Aerospace Engineering.
ATTENUATION OF HIGH-INTENSITY SOUND IN A DROPLET-LADEN GAS Interim Report, Jan. 1974 - Dec. 1975
Frederic A. Lyman Feb. 1976 29 p refs
(Grants NSF ENG-73-04257-A01; NSF GK-41217)
(PB-252985/7; MAE-5192-T1) Avail: NTIS HC $4.00 CSCL 20A

The effect of acoustic streaming on the attenuation of a high intensity plane sound wave propagating in a gas containing a small concentration of micron sized droplets was studied analytically. Calculations are carried out to predict the increase in attenuation resulting from the enhanced droplet heat and mass transfer caused by acoustic streaming. It is concluded that other phenomena must be responsible for the anomalously high attenuation observed in the experiments, and one such phenomenon and the research presently underway to evaluate it are outlined. GRA

N76-33960# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
ASSESSMENT OF NOISE EXPOSURE PRODUCED BY VARIATIONS IN LANDING APPROACH PROCEDURES AT SAN JOSE MUNICIPAL AIRPORT
John F. Mills Aug. 1973 55 p refs
(Contract EPA-68-01-1835)
(PB-253368/5; BBN-2589) Avail: NTIS HC $4.50 CSCL 01E

A series of noise measurements was performed at San Jose Municipal Airport in support of the Environmental Protection Agency Investigation of the use of aircraft operational procedures as means for noise control. These measurements were made to evaluate the effectiveness of different aircraft approach procedures as used in normal practice by several different airlines, to reduce noise received on the ground in the vicinity of the airport. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N76-33961# Oak Ridge National Lab., Tenn.
COMPUTER STUDIES OF THE SCATTERING OF LOW ENERGY HYDROGEN IONS FROM POLY-CRYSTALLINE SOLIDS

O. S. Oen and M. T. Robinson Feb. 1976 13 p refs Presented at 2d Intern. Conf. on Surface Effects in Controlled Fusion Devices, San Francisco, 16 Feb. 1976 Sponsored by ERDA
(CONF-760209-20) Avail: NTIS HC $3.50

Reflection of 50 eV to 10 KeV H atoms from polycrystalline Cu, Nb and Au targets was calculated using the binary collision cascade program MARLOWE. The fractions of particles and energy reflected (backscattered) increase with increasing atomic number of the target and decrease with increasing incident energy. The results indicate that the effects of polycrystallinity are modest, reducing the amorphous reflection coefficients by about 25 percent. The calculations agree with the experimental data for Cu and Au, but are about a factor of two larger than is observed for Nb. NSA

N76-33962# Argonne National Lab., Ill.
THEORETICAL ASPECTS OF ELECTRON CORRELATIONS IN ELECTRON COLLISIONS
M. Inokuti 1975 21 p refs Presented at Conf. on Photoionization and other Probes of Many-Electron Interactions, Carry-le-Rouet, France, 31 Aug. 1975
(Contract W-31-109-eng-38)
(CONF-750820-1) Avail: NTIS HC $4.50

Electron-correlation effects which manifest themselves in diverse facets of electron collisions with an atom or molecule are considered. A fast incident electron acts largely as an external agent, and its inelastic collisions probe the structure, including correlations within the target (in both the initial state and the final state), nearly in the same way as photoionization processes do. In inelastic collisions of a slow electron, the central object of study is the correlated motion of the incident electron and an electron excited out of the target core. This elementary observation is illustrated by many examples and is elaborated by remarks on some current theoretical methods. Author (ERA)

N76-33963# Oak Ridge National Lab., Tenn.
ANALYSIS OF NEUTRON SCATTERING AND GAMMA-RAY PRODUCTION INTEGRAL EXPERIMENTS ON NITROGEN FOR NEUTRON ENERGIES FROM 1 TO 15 MeV
S. N. Cramer and E. M. Blow Mar. 1976 63 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5220) Avail: NTIS HC $4.50

Two integral experiments of neutron scattering and gamma ray production from nitrogen samples were analyzed with Monte Carlo calculations. The experimental results include angular dependent NE-213 detector count rates for both scattered neutrons and gamma ray production from a spherical dewar of liquid nitrogen pulsed with a neutron beam with energies from 1 to 20 MeV. Additional results were reported in the experiments for unfolded scattered neutron and gamma ray production spectra as a function of detector angle in broad incident neutron energy bins. Multigroup Monte Carlo calculations were made to analyze all the reported results. Conclusions were drawn about the status of the ENDF/BIV nitrogen cross section data file from the comparison of calculated and experimental results. Author (ERA)

N76-33964# Brookhaven National Lab., Upton, N.Y.
RADIATION DAMAGE OF NONMETALLIC SOLIDS
A. N. Goland 1975 29 p refs Presented at the Conf. on Radiation Damage in Metals, Cincinnati
(BNL-20719; Conf-751164-1) Avail: NTIS HC $4.00

A review of data and information on radiation damage in nonmetallic solids is presented. Discussions are included on defects in nonmetals, radiation damage processes in nonmetals, electronic damage processes, physical damage processes, atomic displacement, photochemical damage processes, and ion implantation. NSA

N76-33965# Georgia Inst. of Tech., Atlanta. School of Nuclear Engineering.
ASSESSMENT OF FLAT-FLUX AND FLAT-SOURCE APPROXIMATIONS IN GENERATING RESONANCE CROSS SECTIONS Final Report
R. A. Karam and K. D. Kirby 1 Jul. 1975 49 p refs
(Contract AT(40-1)-4750)
(ORO-4750-3) Avail: NTIS HC $4.00

The broad group cross sections of U-238 were compared in the resolved resonance region using: (1) the flat source approximation, (2) the exact source distribution, and (3) the rational approximation with a Levine type factor. The main conclusion was that even though there were significant differences between the exactly calculated escape probabilities and those calculated with the flat source approximation, additional differences between the general energy dependent reciprocity and the energy independent (but often erroneously applied as energy dependent) reciprocity relation almost completely compensated for the error in the flat source escape probabilities. Due to this unusual and somewhat unexpected compensating effect, the effective capture cross sections of U-238 in the resolved resonance region were essentially the same. Author (NSA)

N76-33966# Missouri Univ., St. Louis.
OBSERVATION OF LUMINESCENT SPECTRA IN LOW ENERGY ION-NEUTRAL COLLISIONS Progress Report, 1 Jun. 1975 - 31 May 1976
J. J. Leventhal Feb. 1976 19 p refs
(Contract E(11-1)-2718)
(COO-2718-4) Avail: NTIS HC $3.50

Energy partitioning among internal energy states of the product species resulting from collisions between positive ions and neutral molecules at relative kinetic energies below 500 eV was explored. Two types of inelastic collision processes have been studied: electron exchange, and atomic rearrangement. The data, obtained by direct observation of emission spectra resulting from the decay of excited collision products, were used for product identification and for the determination of state distributions and absolute excitation cross sections. The state distributions were compared to those predicted from theoretical models, and used to elucidate reaction dynamics. The nature of the potential energy curves and surfaces for the species involved is shown to play an important role in determining energetics and excitation cross sections. NSA

N76-33967# California Univ., Berkeley. Lawrence Berkeley Lab.
K VACANCY PRODUCTION IN MEDIUM-Z HEAVY ION COLLISIONS Ph.D. Thesis
R. Anholt Dec. 1975 132 p refs
(Contract W-7405-eng-48)
(LBL-4312) Avail: NTIS HC $6.00

During slow encounters between projectile and target atoms, the electronic atomic wave functions of the two collision partners distort and form molecular orbitals (MOs). The K vacancy formation in slow heavy-ion collisions, which occur when electrons are excited out of the 2p sigma and 1s sigma MOs, is considered. Experimental work using 200 MeV Kr ions is described. The main interest is the excitation of electrons from the 1s sigma MO. The 1s sigma vacancy production is only observed in very asymmetric collisions: as Kr K X rays in encounters with target atoms between H and Ar, and as target K X rays in encounters with atoms between Ce and U. Theoretical approximate calculations of 1s sigma ionization cross sections are described. Author (NSA)

N76-33968# Loughborough Univ. of Technology (England). Dept. of Mathematics.
A NOTE ON THE IMPLEMENTATION OF VARIATIONAL PROCEDURES INVOLVING GREEN'S OPERATORS
M. Blakemore, G. A. Evans, and J. Hyslop Dec. 1975 11 p refs
(MATHS-Res-87) Avail: NTIS HC $3.50

The numerical implementation of a minimum energy principle for atoms and molecules involving integral operators is discussed. It is demonstrated that the use of unscaled trial functions may be as convenient computationally as the earlier procedures involving scaled trial functions and that the revised prescription has advantages, mainly in ease of interpretation and comparison of results. By way of illustration, some earlier calculations on the hydrogen ion are reconsidered and compared. Author (ESA)

N76-33969# Battelle Pacific Northwest Labs., Richland, Wash.
EVALUATION OF THE NEUTRON CROSS SECTIONS OF U-235 IN THE THERMAL ENERGY REGION Final Report
B. R. Leonard, Jr., D. A. Kottwitz, and J. K. Thompson Feb. 1976 111 p refs Sponsored by Elec. Power Res. Inst.

(PB-253718/1; EPRI/NP-167) Avail: NTIS HC $5.50 CSCL 20H

The knowledge of the thermal cross sections of the fissile nuclei was improved, as a step toward providing a standard data base for the nuclear industry. A methodology was developed to perform objective studies to determine best estimate shapes of the partial cross sections in the thermal neutron energy region. Some of the results include: (1) the assessment of the shape uncertainities of the partial cross sections; (2) the development of a recommended set of 2200 m/s (0.0253 eV) values of the parameters and the probable range of further adjustment which might be made; and (3) normalization factors for relative fission and capture cross sections on a common basis with rigorous error estimates. GRA

N76-33970# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
ASYMPTOTICALLY EXACT THEORY OF ELECTRON EXCHANGE IN DISTANT COLLISIONS Final Report
Yu. N. Demkov 1976 16 p refs Repr. from Phys. of Electron. and Atomic Collisions, 1976 p 313-326 Presented at the 9th Intern. Conf. on the Phys. of Electron. and Atomic Collisions, Seattle, 24-30 Jul. 1975
(PB-252396/7) Avail: NTIS HC $3.50 CSCL 07D

The asymptotic theory of resonant charge and spin transfer is reviewed. Only the asymptotic part of the atomic wave function is shown to be important for these processes. The single electron charge transfer formula is generalized to cover the transfer of an arbitrary number of electrons. The extension to the non-adiabatic and noneresonant cases is carried out. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N76-33971# Oak Ridge National Lab., Tenn.
THEORY OF RADIATION INDUCED DEFECT PRODUCTION
M. T. Robinson Oct. 1975 21 p refs Presented at Intern. Conf. on Radiation Damage in Metals, Gatlinburg, Tenn., 5 Oct. 1975 Sponsored by ERDA
(CONF-751006-15) Avail: NTIS HC $4.50

The theory of defect production in solids by neutron irradiation is reviewed, including discussions of the nuclear reactions which produce the primary recoils and the loss of energy from the displacement cascade by electron excitations. The theoretical predictions are compared with the limited available experiments on thermal and fast neutron irradiation. The results are in rough agreement in most instances, but further improvements in the theory are clearly needed. Author (ERA)

N76-33972# Michigan State Univ., East Lansing. Cyclotron Lab.
SUPERCONDUCTING CYCLOTRONS
H. G. Blosser, D. A. Johnson, and R. J. Burleigh 1976 15 p refs Presented at 7th Intern. Conf. on Cyclotrons and Their Applications, Zurich, 19 Aug. 1975 Sponsored by ERDA
(ANL-HEP-CP-76-05; Conf-750824-14) Avail: NTIS HC $3.50

Superconducting cyclotrons are particularly appropriate for acceleration of heavy ions. A review is given of design features of a superconducting cyclotron with energy 440 (Q squared/A) MeV. A strong magnetic field (4.6 tesla average) leads to small physical size (extraction radius 65 cm) and low construction costs. Operating costs are also low. The design is based on established technology (from present cyclotrons and from large bubble chambers). NSA

N76-33973# Oak Ridge National Lab., Tenn.
X-RAY STUDIES OF IRRADIATION INDUCED DISLOCATION LOOPS IN METALS
B. C. Larson 1975 19 p refs Presented at Intern. Conf. on Radiation Damage in Metals, Gatlinburg, Tenn., 5 Oct. 1975 Sponsored by ERDA
(Conf-751006-21) Avail: NTIS HC $4.50

Theoretical and experimental progress has resulted in the increased use of X-rays for the study of defects and defect clusters in crystals. An outline of the theoretical framework associated with Huang, Stokes-Wilson and integral diffuse scattering from dislocation loops is presented, and an account of recent experiments on radiation induced loops is given. These studies include low temperature, ambient temperature, and elevated temperature irradiations of metals with electrons, neutrons, and accelerated ions, and pertain to the study of the thermal annealing characteristics as well as the as-produced damage structure. The information obtained by X-rays as to the type, size and concentrations of dislocation loops is contrasted with existing electron microscopy, electrical resistivity, and lattice parameter data in order to establish correlations and identify areas of disagreement. Author (ERA)

N76-33974# Sandia Labs., Albuquerque, N.Mex.
BREMSSTRAHLUNG CONVERTORS: MATERIALS DESIGN AND DEVELOPMENT
Ronald E. Allred Mar. 1976 28 p refs
(Contract AT(29-1)-789)
(SAND-75-0655) Avail: NTIS HC $4.50

An improved bremsstrahlung convertor for use at high electron beam energies was developed that consists of three main components: (1) conversion foil; (2) electron scavenger; and (3) impulse shield. Structural failures of the impulse sheild were experimentally determined to be caused by shock wave interactions. Convertor materials and design modifications were aimed at attenuation of the magnitude of the shock and maximization of energy absorption by the convertor materials. Techniques proven successful included the introduction of porosity into electron scavenger and impulse shield materials, the use of a standoff between the conversion foil and the electron scavenger, the insertion of a gap between the scavenger and impulse sheild, and the use of advanced composite materials for the impulse shield. Kevlar 49 reinforced resin composites have proven to have the best combination of strength, stiffness, tougness, and X-ray transport properties for use as bremsstrahlung convertor impulse shields. ERA

N76-33975# Florence Univ. (Italy). Facolta d'Ingegneria.
A NEUTRON TRANSPORT PROBLEM [UN PROBLEMA DI TRASPORTO DI NEUTRONI]
Giorgio Busoni, Giovanni Frosali, and Luigi Mangiarotti 1975 22 p refs In ITALIAN Presented at the Seminary of the Ist. di Mat. Appl., Florence, 7 Mar. 1975
Avail: NTIS HC $3.50

A method is given to determine the critical states of a nuclear reactor. Considering the Boltzman equation in integral form, it is shown that the eigenvalues of a special form of this equation provide the answer. The Ritz method is used to find an approximate solution. ESA

74 OPTICS

Includes light phenomena.

N76-33976# California Univ., Berkeley. Lawrence Berkeley Lab.
SOME FUNDAMENTAL ASPECTS OF NONLINEAR OPTICS
Y. R. Shen Sep. 1975 64 p refs Presented at meeting on Nonlinear Optical Spectroscopy, Varenna, Italy, 30 Jun. 1975
(Contract W-7405-eng-48)
(LBL-4179; Conf-7506104-3) Avail: NTIS HC $4.50

Selected topics related to the fundamentals of nonlinear optics are discussed. A brief description on the theory of nonlinear optical susceptibilities is given. Emphasis is on the basic properties, on the recently developed bond theory, on the dispersion of nonlinear susceptibilities, and on the coupled wave approach. The transverse resonant excitation in material can be treated as a material excitational wave, and most nonlinear optics problems can be understood as results of coupling between em waves or em and material excitational waves. The examples include sum

and difference frequency generation, Raman scattering by coherent excitation, stimulated Raman and stimulated polariton scattering, four wave mixing, and vibrational relaxation measurements. The physical distinction between laser emission and resonant stimulated Raman scattering in an optically pumped three level system are considered. Author (ERA)

N76-33977# Sandia Labs., Albuquerque, N.Mex.
RESPONSE OF PHOTOCHROMIC MATERIALS TO INTENSE LIGHT FLASHES
L. A. Harrah Feb. 1976 29 p refs
(Contract AT(20-1)-789)
(SAND-75-0402) Avail: NTIS HC $4.00

Calculations were performed to estimate the ability of triplet photochromic materials to limit the visible fluence from nuclear flashes. The parameters chosen for the triplet state absorption in the visible were based on an oscillator strength of unity and an absorption spectrum covering from 405 to 650 nm. A triplet state population quantum efficiency of 0.3 was used as representative of the reported values for molecules absorbing in this region. Analytical expressions were derived for both short pulses and for the steady state case. For the nuclear flashes where the time of the pulse is comparable to the triplet decay time, a computer solution is used to calculate the achieved optical density and transmitted fluence as a function of time. From these calculations, it is concluded that photochromics can provide thermal protection but probably cannot prevent temporary flash blindness. Author (NSA)

N76-33978# National Bureau of Standards, Washington, D.C.
THE CALIBRATION OF AN OPTICAL FLAT BY INTERFEROMETRIC COMPARISON TO A MASTER OPTICAL FLAT Final Report
Charles P. Reeve Dec. 1975 40 p refs
(PB-253113/5; NBSIR-75-975) Avail: NTIS HC $4.00 CSCL 20F

Optical flats are normally calibrated by one of two methods at the National Bureau of Standards. The most frequently used method involves a direct interferometric comparison of a test flat to a master flat. The purpose of this paper is to present a detailed description of this measurement process. Some of the topics discussed are methods of supporting the flats, effects of gravitational bending, measurement of interference fringes, formulation and solution of the linear least squares model, analysis of errors, choice of profile reference line, and graphical display of profiles. An example is worked out in a step-by-step fashion in order to illustrate the process, and a statistical test is incorporated to check whether the process is in control. GRA

N76-33979# Illinois Univ., Urbana. Radio Research Lab.
OPTICAL WAVE PROPAGATION IN INHOMOGENEOUS RANDOM MEDIA Final Report
Peter C. Lam and Chester S. Gardner Mar. 1976 81 p refs
(Grant NSF GK-42079)
(PB-252381/9; UILU-ENG-76-2543; RRL-Pub-472) Avail: NTIS HC $5.00 CSCL 20F

The parabolic equation method was used to study the behavior of optical wave propagation through inhomogeneous turbulent media of finite extent. The refractive index covariance was given by the product of a function depending on the difference coordinate and another function depending on the average coordinate. Parabolic equations were obtained for the average field and the second order mutual coherence function. Approximate solutions to these equations were obtained for the case of plane, spherical, and beam wave propagation. Results show a high dependence on the transverse extent of the medium and are significantly different from the corresponding results for the homogeneous medium. GRA

N76-33980# Colorado State Univ., Fort Collins. Dept. of Earth Resources.
SKYLAB CONCENTRATED ATMOSPHERIC RADIATION PROJECT. EXECUTIVE SUMMARY
W. E. Marlatt, D. A. Rainey, W. K. Reeser, and D. S. Renne Oct. 1975 30 p refs
(Contract NOAA-03-3-022-85)
(PB-253174/7; NOAA-76031705) Avail: NTIS HC $4.00 CSCL 20F

The accuracy and applicability of a number of mathematical models is used to determine the effect of the atmospheric path between the earth's surface and the spacecraft sensor. The effects of wet and dry aerosols on specific bandpasses in the visible and thermal infrared spectrum are evaluated. The index of refraction and presence or absence of water coatings on the atmospheric aerosol is found to be critical to determination of the influence of aerosols on infrared transmission through the atmosphere. A set of six models was used to determine the visible radiation transfer in a scattering atmosphere. GRA

N76-33981# National Bureau of Standards, Washington, D.C.
PIEZO-OPTICAL CONSTANTS IN THE INFRARED Final Report
Albert Feldman, Deane Horowitz, and Roy M. Waxler Feb. 1976 10 p refs Presented at the 5th Conf. on Infrared Laser Window Materials, Las Vegas, Nev., 1-4 Dec. 1975 p 944-951 Sponsored by DARPA Submitted for publication
(PB-253540/9) Avail: NTIS HC $3.50 CSCL 20F

The piezo-optical constants q11, q12, and q44, and the elasto-optical constants p11, p12, and p44, were obtained at 10.6 micrometers for pure KCl grown by the reactive atmosphere process and for KCl nominally doped with 1 percent KI. Within experimental error, the coefficients of the two materials agree. Negligible dispersion is found for q11, q12, and p12 between the visible and 10.6 micrometers while a small dispersion is found for q44 and p44. GRA

N76-33982# Michigan Univ., Ann Arbor. Dept. of Electrical and Computer Engineering.
SUPER-RESOLUTION OF ROTATING OBJECTS Final Report, Dec. 1974 - Dec. 1975
C. C. Aleksoff 30 Jan. 1976 16 p
(Grant DAHC04-75-G-0054)
(AD-A022563; ARO-12374.2-R-EL) Avail: NTIS CSCL 17/8

It is shown that if an object passes through an interference field, a one-dimensional image can be formed along the direction of motion via synthetic aperture techniques. This technique, labeled Synthetic Interferometer Imaging depends on electronically detecting the intensity of the time varying signal scattered by the object. The detected signal is then, in general, match filtered to give the image. This technique was demonstrated using interference between two laser beams of the Hermite-Gaussian type with different transverse order number. For the case where the interference field is formed by two coherent point sources, a spatial recording of the detected signal produces a simple hologram of the object. The effective (synthetic) aperture of this hologram, and hence the image resolution, is proportional to the recording time and is also dependent on the geometry of the system. GRA

N76-33983# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.
POSITION ESTIMATION FOR A SCAN SYSTEM VIA NONLINEAR FILTERING. PART 2: MOVING TARGET, SPATIALLY CORRELATED NOISE, MONTE CARLO SIMULATION RESULTS Interim Report
K. K. Wong 1 Mar. 1976 67 p refs
(Contracts F04701-74-C-0075; F04701-75-C-0076)
(AD-A022597; TR-0075(5901-03)-2-Pt-2;
SAMSO-TR-74-219-Pt-2) Avail: NTIS CSCL 17/8

In this part of the report, a position estimation algorithm for a moving target intensity signal corrupted by spatially correlated Gaussian noise is derived. The results in this report are extensions of those obtained in Part I which deals with a stationary target signal corrupted by white Gaussian noise. Monte Carlo simulation results are presented for both the stationary target case and the moving target case. Author (GRA)

N76-33984# Army Aeromedical Research Lab., Fort Rucker, Ala. Bio-Optics Div.
VISION WITH THE AN/PVS-5 NIGHT VISION GOGGLE
Roger W. Wiley and Frank F. Holly 8 Apr. 1976 21 p refs
(AD-A022782) Avail: NTIS CSCL 17/8

This paper presents the results from a series of experiments in which visual performance using the AN/PVS-5 night vision goggle was measured. Modulation transfer functions of the man-goggle system were determined and compared to results

obtained with unaided viewing. It was found that the man-goggle system performance was superior to unaided visual performance at average target luminances equivalent to 5% and 25% moon illuminances. At a target luminance equivalent to a full moon illuminance, unaided visual performance was superior at higher spatial frequencies, while remaining poorer at the lower spatial frequencies. Using a modified Howard-Dolman apparatus, it was determined that the stereoscopic threshold was degraded with the man-goggle system. Field measurements of relative depth discrimination using all available visual cues showed that performance of the man-goggle system was statistically equivalent to unaided photopic visual performance at intermediate viewing distances, but was inferior to unaided viewing at distances of 500 feet or greater. While the night vision goggle reduces the ambient light level necessary for military rotary wing support, use of the goggle does not allow the operator to perform with photopic visual efficiency. Author (GRA)

N76-33985# Hughes Research Labs., Malibu, Calif.
SPACE OBJECT IMAGING Final Technical Report, 17 Apr. 1974 - 16 Jun. 1975
C. R. Giuliano, J. A. Jenney, L. Miller, M. E. Pedinoff, D. Y. Tseng, and S. M. Wandzura Griffiss AFB, N. Y. RADC Mar. 1976 195 p ref
(Contract F30602-74-C-0227; ARPA Order 2646; AF Proj. 2646)
(AD-A023497; RADC-TR-76-54) Avail: NTIS CSCL 17/8

This report consists of two major parts. The first part contains a description of the Seeing Monitor, a system that was designed, fabricated, and tested on this program. The Seeing Monitor is an optical instrument that samples star images on a millisecond time scale and provides information on atmospheric seeing conditions. In this system star images are scanned in orthogonal directions by a spinning reticle wheel and the light transmitted through the wheel is processed to yield the modulation transfer function of the atmosphere, the seeing angle, and image wander information. The Seeing Monitor test results show satisfactory performance for stars of visual magnitude up to about 6.5 and a dynamic range for seeing angles of 0.1 to 10 arc seconds. The second part of the report describes a series of experiments and computer simulations that were performed in preparation for a feasibility demonstration experiment of Polarization Reference Imaging (PRIM) at AMOS. The experiments performed in the laboratory at hrl as well as the ruby laser experiments at amos all indicate that the demonstration experiment is feasible. GRA

N76-33986# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
FLIR IMAGE ANALYSIS WITH THE AUTOSCREENER COMPUTER SIMULATION, VOLUME 1 Final Report
Meletios Geokezas Feb. 1976 88 p refs
(Contract DAAG53-75-C-0264)
(AD-A022755) Avail: NTIS CSCL 17/5

The final report presents the results of a recent investigation to assess the feasibility of automatic target cueing technology in detecting and recognizing tactical targets in FLIR imagery. The FLIR imagery data in digital form as well as in transparencies was furnished by the U.S. Army Night Vision Laboratory. The digital data was processed by Honeywell's digital computer simulation of the Autoscreener hardware. The digital processing extracts the first level features (edge and contrast information) from which object intervals and candidate objects are extracted. Each candidate object is represented by a vector with eighteen components based on the object shape and its texture. The classifier design was investigated next. Based on statistical methods ten features were selected; one set for large objects and another for small objects. The large/small object separation was based on size. In addition a training and test set was selected. The classifier for each case was trained by generating six discriminant functions, the decision space and training confusion matrix. The classifier was then tested on the remaining set (test set) and the confusion matrix was generated and evaluated using ground truth. The overall system as well as the classifier detection, recognition and false alarm probabilities were estimated. GRA

N76-33987# Office of Naval Research, London (England).
INFRARED DETECTOR CHARACTERISTICS: MEASUREMENT AND USE
Roy F. Potter 31 Dec. 1975 19 p refs Presented at the Intern. School: Quality Assurance of Opt. and Electro-opt. Systems, Delft, Neth., 3 Sep. 1975
(AD-A022693; ONRL-R-22-75) Avail: NTIS CSCL 17/5

Infrared photodetectors having electrical outputs directly proportional to the radiant signal power input can be described in terms of specific and well-defined parameters. These parameters and the associated measurement techniques are briefly outlined. Methods are suggested for extrapolating and interpolating from standard report data in order to prepare specific engineering information about expected operational detector performance. GRA

N76-33988# Washington Univ., Seattle. Dept. of Electrical Engineering.
OPTICAL FIBER COUPLING AND STRENGTH TESTS Semiannual Report, 1 Mar. - 31 Aug. 1975
George L. Mitchell and William D. Scott Sep. 1975 7 p refs
(Contract N00123-73-C-1200)
(AD-A023491) Avail: NTIS CSCL 20/6

This report summarizes contract research through September 1, 1975, and defines design requirements for an efficient transition fiber to couple the rectangular output aperture of a semiconductor laser to round single mode fiber cores. Fiber strength testing and strength improvement processing work has been completed with results of strength tests on fibers of lengths up to 15 meters. Author (GRA)

N76-33989# RCA Labs., Princeton, N.J.
WAVEGUIDES IN LITHIUM NIOBATE-TANTALATE Final Report, 1 Jun. 1974 - 31 May 1975
William Phillips and Jacob M. Hammer Mar. 1976 63 p refs
(Contract N00014-74-C-0320; NR Proj. 009-012)
(AD-A023831; PRRL-75-CR-50) Avail: NTIS CSCL 20/12

This contract concerned obtaining as complete a description as possible of the formation of diffused lithium niobate-tantalate waveguides and determining the optimum processing conditions for them. In the final portion of the work, the goals were (1) to complete the analytic study of the waveguides begun earlier, (2) to study the factors contributing to waveguide losses and determine the limits within which low-loss waveguides can be fabricated, and (3) to study the formation and optical characteristics of stripe guides. GRA

N76-33990# Naval Research Lab., Washington, D.C.
CALORIMETRIC METHOD OF SENSITIVITY CALIBRATION FOR FAR-INFRARED DETECTORS Interim Report
Mark Daehler 16 Apr. 1976 20 p refs
(NRL Proj. A01-061; RR0340642)
(AD-A024224; NRL-7976) Avail: NTIS CSCL 17/5

A calorimetric method for measuring the absolute spectral sensitivity of a far-infrared (100 micrometers to 5 mm) detector was developed. The method uses a liquid-helium-cooled integrating-sphere calorimeter capable of measuring a radiative power of the order of 1 microwatt. A preliminary sensitivity measurement of an InSb detector at 3.4 mm has been made. Author (GRA)

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N76-33991*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIMINIODE THERMIONIC CONVERSION WITH 111-IRIDIUM ELECTRODES
Erich W. Koeger, Virginia L. Bair, and James F. Morris Sep. 1976 11 p refs
(NASA-TM-X-73492; E-8888) Avail: NTIS HC $3.50 CSCL 20I

Preliminary data indicating thermionic-conversion potentialities for a 111-iridium emitter and collector spaced 0.2 mm apart are presented. These results comprise output densities of current

and of power as functions of voltage for three sets of emitter, collector, and reservoir temperatures: 1553, 944, 561 K; 1605, 898, 533 K; and 1656, 1028, 586 K. For the 1605 K evaluation, estimates produced work-function values of 2.22 eV for the emitter and 1.63 eV for the collector with a 2.0-eV barrier index (collector work function plus interelectrode voltage drop) corresponding to the maximum output of 5.5 W/sq cm at 0.24 volt. The current, voltage curve for the 1656 K 111-iridium diminiode yields a 6.2 W/sq cm maximum at 0.25 volt and is comparable with the 1700 K envelope for a diode with an etched-rhenium emitter and a 0.025-mm electrode gap made by TECO and evaluated by NASA. Author

N76-33992# Princeton Univ., N.J. Plasma Physics Lab.
NUMERICAL STUDY OF THE MHD SPECTRUM IN TOKAMAKS WITH A NONCIRCULAR CROSS SECTION
W. Kerner Mar. 1976 43 p refs
(Contract E(11-1)-3073)
(MATT-1229) Avail: NTIS HC $4.00

The behavior of a class of exact Tokamak equilibria was investigated in the context of ideal magnetohydrodynamics. An equilibrium solution was developed which allows for a general plasma cross section shape, restricted to systems with essentially flat toroidal current profiles. The spectrum of the eigenmodes was evaluated by extremizing the Lagrangian using a Galerkin procedure. The different branches of the spectrum were appropriately represented by expanding the eigenfunctions in terms of the eigenfunctions of the corresponding straight limit. The perturbed vacuum field was expressed by a vector potential. The code was applied to various configurations with a fixed and with a free plasma boundary. The influence of ellipticity of the cross section and of the aspect ratio on the spectrum is discussed. NSA

N76-33993# Princeton Univ., N.J. Plasma Physics Lab.
FAST-WAVE HEATING OF A TWO-COMPONENT PLASMA
T. H. Stix Feb. 1975 56 p refs
(Contract AT(11-1)-3073)
(MATT-1113) Avail: NTIS HC $6.00

The use of the compressional hydromagnetic mode is examined with respect to the heating of a tritium plasma containing a few percent deuterium. Efficient absorption of wave energy by the deuteron component is found when omega equals omega/sub c/ (deuterons), with Q/sub wave/greater than or equal to 100. The dominant behavior of the high-energy deuteron distribution function is found to be f(v) approximately exp[3/2) integral/sup v/ [DELTA v]/[(DELTA v/sub perpendicular/)2], where [DELTA v] is the Chandrasekhar-Spitzer drag coefficient, and [(DELTA v/ sub perpendicular/)2] is the Kennel-Englemann quasilinear diffusion coefficient for wave-particle interaction at the deuteron cyclotron frequency. An analytic solution to the one-dimensional Fokker-Planck equation, with rf-induced diffusion, is developed, and using this solution together with Duane's fit to the D-T fusion cross-section, it is found that the nuclear fusion power output from an rf-produced two-component plasma can significantly exceed the incremental (radiofrequency) power input.
Author (NSA)

N76-33994# Princeton Univ., N.J. Plasma Physics Lab.
MEASUREMENT OF THE ENERGY BALANCE IN ATC TOKAMAK
H. Hsuan, K. Bol, and R. A. Ellis Jan. 1976 17 p refs
(Contract AT(11-1)-3073)
(MATT-1098) Avail: NTIS HC $4.00

Gross properties of the energy balance in the ATC Tokamak have been investigated. During the quasi-steady state phase of a normal discharge, the major part of the energy loss was found to be the limiters. Radiation and charge exchange play minor roles during this quasi-steady state phase, but are nevertheless the dominant loss mechanisms at the termination of a discharge; and account for a substantial portion of the stored poloidal magnetic energy associated with the plasma current.
Author (NSA)

N76-33995# Princeton Univ., N.J. Plasma Physics Lab.
WAVE GENERATION AND HEATING IN THE ST TOKAMAK AT THE FUNDAMENTAL AND HARMONIC ION CYCLOTRON FREQUENCIES
J. Adam, M. Chance, and H. Eubank Dec. 1974 10 p refs
(Contract AT(11-1)-3073)
(MATT-1094; IAEA-CN-33/A3-2) Avail: NTIS HC $4.00

Theoretical and experimental investigations are reported of wave generation and heating at the fundamental and the first harmonic of the ion cyclotron frequency. General theoretical considerations are followed by a description of experiments on the ST Tokamak designed to test the feasibility of this heating scheme for providing the additional heating required for toroidal reactor operation. Two RF coils were used in an enlarged section of the ST vacuum vessel to allow operation up to approximately 1 MW of RF power. Wave generation efficiencies of approximately 90 percent were computed from theory and observed experimentally. The ion cyclotron (slow) wave is observed to be strongly damped but the fast hydromagnetic wave is seen to propagate many times around the machine so that standing toroidal eigenmodes are generated. The dependence of the eigenmode resonances on the density and magnetic field agrees closely with a theory based on cylindrical, cold-plasma model.
Author (NSA)

N76-33996# Princeton Univ., N.J. Plasma Physics Lab.
PLT NEUTRAL INJECTION IGNITRON ACCELERATING SUPPLY
D. L. Ashcroft, J. G. Murray, R. A. Newman, and F. L. Peterson Mar. 1976 12 p refs
(Contract E(11-1)-3073)
(MATT-1225) Avail: NTIS HC $3.50

A phase controlled rectifier was designed for the accelerating supply on the PLT neutron beam injection system. The rectifier must furnish 70 amperes at up to 50 KV for 300 milliseconds, with a duty cycle of up to 10 percent. Protection of the injectors requires the supply to withstand repeated crowbarring. The rectifying element selected to satisfy these requirements was a commercially available ignitron, installed in a supporting frame and using firing circuits and controls. ERA

N76-33997# Oak Ridge National Lab., Tenn.
UNCERTAINTIES IN CALCULATED HEATING AND RADIATION DAMAGE IN THE TOROIDAL FIELD COIL OF A TOKAMAK EXPERIMENTAL POWER REACTOR DUE TO NEUTRON CROSS-SECTION ERRORS
R. G. Alsmiller, Jr., J. Barish, and C. R. Weisbin Mar. 1976 67 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5198) Avail: NTIS HC $6.00

Calculated results are presented of the uncertainties in the neutron scalar flux, the energy deposition per unit volume, and the displacements per atom in the toroidal field coil of a Tokamak experiment power reactor. These uncertainties were due to neutron cross section errors in iron and carbon which are major constituents of the blanket shield coil configuration considered. The calculations were carried out using perturbation theory to obtain sensitivity profiles for the various cross sections of interest, and these profiles were then combined with cross section error estimates, including correlations, to obtain the uncertainties. Each of the three responses-the neutron scalar flux, the energy deposition per unit volume, and the displacements per atom were found to be very sensitive to the cross sections in the energy group which contains the source and each of the responses were found to have a relative standard deviation of approximately 100 percent due to neutron cross section errors in iron. NSA

N76-33998# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
PLASMA INSTABILITIES OF A RELATIVISTICALLY STRONG ELECTROMAGNETIC WAVE
M. Dobrowolny, A. Ferrari, and G. Bosia Mar. 1975 28 p refs
(LPS-75-6) Avail: NTIS HC $4.00

The theory refers to waves with linear polarization and strength parameters. Excitation of both electrostatic modes in the plasma and electromagnetic modes is shown to be possible. The corresponding instabilities are discussed as a function of the strength parameter, going from weakly relativistic to strongly relativistic cases. The two situations of the strong electromagnetic

wave being either a wave in the plasma or an external pump are considered. Author (ESA)

N76-33999# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
VELOCITY SHEAR INSTABILITIES IN HIGH BETA COLLISIONLESS PLASMAS
M. Dobrowolny Mar. 1976 38 p refs
(LPS-76-9) Avail: NTIS HC $4.00

Possible instabilities of a collisionless magnetized plasma of arbritary beta in the presence of parallel velocity shear were investigated for arbitrary direction of wave propagation. A local instability analysis of two fluid equations, including the effect of finite Larmor radius for the plasma ions, leads to instability prediction for wave propagation almost perpendicular to the magnetic field direction, both for Alfven and slow magnetosonic modes. For propagation within a cone around the magnetic field direction, only Alfven incompressible waves were found to be unstable. At small values of the velocity shear the unstable cones narrow around the two directions perpendicular and parallel to B. Instability criteria are derived and discussed in detail.
Author (ESA)

N76-34000# Oxford Univ. (England). Engineering Lab.
CURRENT INDUCED ION OSCILLATIONS IN A BOUNDED THERMALLY PRODUCED PLASMA Interim Report
A. D. R. Phelps and J. E. Allen 1976 23 p refs Sponsored in part by Sci. Res. Council and UKAEA
(OUEL-1149/76) Avail: NTIS HC $3.50

Measurements of the temperature dependence of the frequency of one of the low frequency modes of oscillation of a current carrying, bounded, thermally produced plasma are reported. Comparison is made with the predictions of a collision-free theory, which predicts an oscillation frequency proportional to the square root of the plasma temperature. Measurements show that the frequency increases as a function of increasing plasma temperature over the temperature range from 2,000 to 2,500 K more rapidly than predicted by a square root power law. Reasons for this are discussed. It was observed that the constant frequency oscillation shows a small frequency variation as the applied potential is varied. The collision-free theory, was developed to include applied potentials smaller than that required to cause current saturation and predicts an oscillation frequency which is a function of the applied potential. The theory is extended to include damped ion acoustic oscillations, which become the appropriate mode of oscillation as the applied potential approaches zero. Author (ESA)

N76-34001# General Electric Co., Philadelphia, Pa. Space Div.
MHD GENERATOR INVESTIGATIONS Annual Report, 1 Jan. - 31 Dec. 1975
Charles H. Marston, E. Tate, and Bert Zauderer Mar. 1976 130 p refs
(Contract N00014-73-C-0039)
(AD-A023417) Avail: NTIS CSCL 10/2

Work during the past year has been focused on two distinct areas. Interest in the production of intense, short duration pulses of electric energy prompted investigation of a self-excited MHD generator capable of doing this job. Feasibility of the concept was established and design of the first test channel completed. Some experiments were also conducted on the non-equilibrium closed cycle MHD generator, which in 1974 achieved a record enthalpy extraction of 19.3%. The emphasis was on reducing stagnation temperature from 3520 K where the record was achieved to the 2000 K level, which is compatible with available energy sources. Both the shock tunnel and the MHD generator become more difficult to operate as temperature drops, but results are encouraging. Author (GRA)

N78-34002# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
STUDY OF PLASMA ENHANCEMENT AND DIAGNOSTIC POSSIBILITIES OF SELECTIVE EXCITATION SPECTROSCOPY Final Report, 1 Aug. 1972 - 31 Aug. 1975
R. M. Measures Feb. 1976 18 p refs
(Grant AF-AFOSR-2442-73; AF Proj. 9752)
(AD-A023180; AFOSR-76-0162TR) Avail: NTIS CSCL 20/9

In order to study laser selective excitation of a wide variety of metal vapor plasmas, a versatile laser ablation facility that avoids many of the technical difficulties associated with other approaches to studying such plasmas was developed.
Author (GRA)

N76-34003# Jones (Malcolm) Associates, Inc., Corona Del Mar, Calif.
FUNDAMENTAL RESEARCH IN EXPLOSIVE MAGNETOHYDRODYNAMICS Final Report, 1 Oct. 1974 - 31 Dec. 1975
Malcolm S. Jones, Jr. Feb. 1976 84 p refs
(Contract F44620-75-C-0017; AF Proj. 9752)
(AD-A023135; AFOSR-76-0435TR) Avail: NTIS CSCL 20/9

The background experimental work with explosive driven MHD generators is reviewed and the major parametric factors are outlined. Previously unpublished data on the effects of the density and composition of gases originally in the channel is reviewed and it is shown that the major conduction path is through the seeded detonation products and that the role of the gas is secondary. Unpublished data on experiments with bulk seeded charges is also presented. It is shown that RDX charges surface seeded with more than 100 mg of cesium picrate produced better results than any of the bulk seeded charges tested, which contained up to 25% CsNO3. A deleterious interaction was observed when bulk seeded charges were surface seeded with cesium picrate. Analysis of this data also revealed that the anomolously high internal inductance of the explosive driven MHD generator was reduced by increasing the seed level, meaning that the seed effects both the plasma conductivity and inductance. The effect of various circulating current systems on the explosive derived plasma slug are examined. It is determined that diamagnetic surface currents coupled with a thermal ionization instability producing a 'T-layer' can be responsible for the maintenance of the plasma conductivity in the generator. However, such a mechanism cannot be responsible for the initial conductivity observed in the vicinity of the explosive charge in the absence of a magnetic field. The physical basis for this original conductivity is uncertain. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N76-34004*# Scientific Translation Service, Santa Barbara, Calif.
CONTROL AND REGULATION OF VAPOR DEPOSITION PROCESSES BY THE QUARTZ CRYSTAL VIBRATOR METHOD
Klaus Berger and Arno Illenberger Washington NASA Sep. 1976 21 p refs Transl. into ENGLISH from Bosch Tech. Ber. (West Ger.), v. 2, no. 2, Nov. 1968 p 245-252
(Contract NASw-2791)
(NASA-TT-F-17231) Avail: NTIS HC $3.50 CSCL 20B

The errors affecting the measurement of mass loading with quartz crystal vibrators were investigated. Frequency shifts caused by heating or clamping stress in the crystal can be avoided by use of a suitable clamping device. A diaphragm in front of the crystal on the other hand, leads to radial temperature gradients and frequency shifts, which cannot be completely eliminated but can be taken into account in calculating results. An apparatus for the measurement of mass loading and deposition rates is described, and its application in the control of vapor deposition is explained. Author

N76-34005*# Kanner (Leo) Associates, Redwood City, Calif.
TEMPERATURE EFFECTS IN THE MEASUREMENT OF THE THICKNESS QF VACUUM-DEPOSITED FILMS BY THE QUARTZ OSCILLATOR METHOD
Karl Kerner Washington NASA Sep. 1976 10 p refs Transl. into ENGLISH from Bosch Tech. Ber. (West Ger.), v. 2, no. 5, Nov. 1968 p 253-256
(Contract NASw-2790)
(NASA-TT-F-17232) Avail: NTIS HC $3.50 CSCL 20L

The dependence of resonance frequency upon temperature in thickness measurement made by the quartz oscillator method

is investigated. It is shown that a frequency shift also occurs based on temperature difference within the oscillating region of the quartz. It is indicated that this additional frequency shift must be taken into consideration when measuring film thickness and deposition rate if high accuracy is to be achieved. Author

N76-34006*# Kanner (Leo) Associates, Redwood City, Calif.
CAPACITIVE MEASUREMENT OF THE THICKNESS OF THIN PROTECTIVE QUARTZ FILMS DEPOSITED ON ALUMINUM REFLECTORS
Heinrich Knapp Washington NASA Sep. 1976 11 p refs Transl. into ENGLISH from Bosch Tech. Ber. (West Ger.), v. 2, no. 5, Nov. 1968 p 256-260
(Contract NASw-2790)
(NASA-TT-F-17233) Avail: NTIS HC $3.50 CSCL 20L

An apparatus for the capacitive measurement of the thickness of a thin quartz film on an aluminum substrate is described. This protective quartz film is deposited on top of a freshly evaporated aluminum film by electron beam evaporation. A particular form of evaporation apparatus makes possible comparison with optical interferometric measurements. The results obtained by the two methods differ, the difference is dependent on the conditions of deposition. Possible causes for the difference are discussed. Author

N76-34007*# Scientific Translation Service, Santa Barbara, Calif.
THERMAL VARIATION OF PAULI PARAMAGNETISM: PREGRAPHITIC CARBONS
P. Delhaes and A. Marchand Washington NASA Oct. 1976 18 p refs Transl. into ENGLISH of J. Phys. (Paris), v. 28, Jan. 1967 p 67-74
(Contract NASw-2791)
(NASA-TT-F-17243) Avail: NTIS HC $3.50 CSCL 20L

Pregraphitic carbons are carbons which have not undergone the complete transformation, through heat treatment, into graphite. This class of solids, where the Fermi level is very close to the top of the pion valence band, exhibits a temperature dependent Pauli paramagnetism, which can be studied by means of E.S.R. The variation of the Pauli paramagnetism with t is qualitatively and quantitatively dependent on the crystal structure of the carbons. An interpretation of the experimental data, by making use of a suitable band structure model, leads to a better understanding of the main features of the electronic energy bands and makes it possible to follow their changes during the course of the graphitization process. The investigation of this paramagnetism thus appears to be an interesting approach to the detection of the electronic band structure of some solids. Author

N76-34008*# Kanner (Leo) Associates, Redwood City, Calif.
STUDY OF METAL ALLOYS UNDER MECHANICAL STRESS BY MOSSBAUER SPECTROMETRY
C. Janot and O. Delcroix Washington NASA Oct. 1976 27 p refs Transl. into ENGLISH from Acta Met. (England), v. 24, Mar. 1976, p 197-206
(Contract NASw-2790)
(NASA-TT-F-17261) Avail: NTIS HC $4.00 CSCL 20L

The characteristic parameters of the Mossbauer spectrum of a metallic alloy can be modified by the application of an external mechanical stress which introduces local variations in the spin or the charge density, and modifications of the symmetries or the amplitude of the atomic vibrations. These effects can be used to give a microscopic interpretation of the mechanical properties of a material. Research effects are reported that have confirmed in some simple systems, regardless of the nature of the applied stress (high hydrostatic pressure, uniaxial compression or tension), the observed effects can always be qualitatively interpreted in the same manner. A complete study on a composite material (aluminum reinforced with Al3Fe fibers) made it possible to characterize the different phases of deformation of the fibers. Author

N76-34009# California Univ., Berkeley. Lawrence Berkeley Lab.
NONLINEAR OPTICAL STUDY OF PRETRANSITIONAL BEHAVIOR IN LIQUID CRYSTALLINE MATERIALS
Y. R. Shen Sep. 1975 16 p refs Presented at Proc. on Nonlinear Optical Spectroscopy, Varenna, Italy, 30 Jun. 1975
(Contract W-7405-eng-48)
(LBL-4178; Conf-7506104-2) Avail: NTIS HC $4.50

A case is discussed in which the optical Kerr effect is used to probe the pretransitional behavior of the isotropic yields nematic transition in a liquid crystal. The experimental arrangement to carry out such a measurement is described. ERA

N76-34010# California Univ., Berkeley. Lawrence Berkeley Lab.
RESONANT RAMAN SCATTERING NEAR EXCITONIC TRANSITIONS
Y. R. Shen Sep. 1975 32 p refs Presented at Soviet-Am. Symp. on Theory of Light Scattering in Solids, Moscow, 26 May 1975
(Contract W-7405-eng-48)
(LBL-4170; Conf-750582-1) Avail: NTIS HC $5.00

The cases of Cu2O and MnF2 are used to illustrate the principles and usefulness of the resonant Raman technique. It is shown that the resonant Raman results can give not only a better understanding of the phonon (magnon) structure but also more details about the excitonic structure and the coupling between excitons (or electrons and holes) and phonons (magnons). Author (ERA)

N76-34011# Brookhaven National Lab., Upton, N.Y.
VIRTUAL SPIN WAVES IN ITINERANT FERROMAGNETS ABOVE T SUB c
M. A. Klenin (State Univ. of NY, Stoney Brook) and J. A. Hertz (Chicago Univ., Ill.) 1975 6 p refs Presented at 21st Ann. Conf. on Magnetism and Magnet Mater, Philadelphia, 9 Dec. 1975 Sponsored by ERDA and NSF
(BNL-20598; Conf-751209-14) Avail: NTIS HC $3.50

A microscopic calculation of the dynamic susceptibility in itinerant (Hubbard-like) paramagnets is carried out using a reformulation of theory which retains rotational invariance explicitly. Because the fluctuating order parameter has the character of a three-dimensional vector field, the susceptibility calculated within a generalized Hartree theory is found to include both transverse (spinwave-like) and longitudinal (Stoner-like) response. The results indicate the appearance of propagating spinwave-like collective modes and a virtual spin splitting of the single particle density of states, as well as the smearing of the single-particle band structure. Damping occurs because of the analytic form of the Stoner-like part and because of fluctuations of the effective gap parameter entering into the spin wave part. Author (ERA)

N76-34012# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
APPLICATION OF THE COLLECTIVE VARIABLE METHOD TO THE INVESTIGATION OF THE ELECTROLYTE FILM
I. R. Yukhnovskii and I. I. Kurylyak 1975 33 p refs In RUSSIAN
(ITP-75-25R) Avail: ERDA Depository Libraries HC $4.00

The electrolyte film limited by different media is considered. The Hamiltonian of the system is constructed. The explicit expressions for the S-particle distribution function are obtained. The one-particle distribution function in the zero approximation for the continuum model is computed. The ion density distribution curves inside the film limited by different media are built. The cluster expansions for the S-particle distribution function are obtained up to the cluster integrals with two field vertices. Author (ERA)

N76-34013# Cornell Univ., Ithaca, N.Y. .Lab. of Atomic and Solid State Physics.
POLARIZABILITY OF THE LOW FREQUENCY EXCITATIONS IN DISORDERED SOLIDS
R. B. Stephens Oct. 1975 24 p refs
(Contract AT(11-1)-3151)
(COO-3151-60) Avail: NTIS HC $4.50

An attempt to find manifestations of an electric dipole moment associated with the low temperature thermal properties of glasses has enabled the setting of very low limits for GeO2 and PMMA, 0.06 and 0.16 Debye respectively. Measurements of the temperature dependence of the dielectric constant and the electric field dependence of the thermal conductivity of SiO2 in conjunction with dielectric measurements has pinned down some of the features of a tunneling systems model. The potentials must be

nearly symmetric, and the distribution of these states must be considerably more uniform than one would calculate from measurements of the specific heat of SiO2. ERA

N76-34014# Argonne National Lab., Ill.
RADIATION EFFECTS ON SUPERCONDUCTIVITY
B. S. Brown 1975 37 p refs Presented at ASM Seminar on Mater. Sci., Cincinnati, 9 Nov. 1975
(Contract W-31-109-eng-38)
(Conf-751160-1) Avail: NTIS HC $4.00

The effect of radiation on the superconducting transition temperature (T/sub c/), upper critical field (H/sub c2/), and volume-pinning-force density (F/sub p/) were discussed for the three kinds of superconducting materials (elements, alloys, and compounds). Author (ERA)

N76-34015# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
DISCRETE AND CONTINUOUS FRANCK-CONDON FACTORS OF THE A SUP 1 SIGMA (SUP+) SUB u YIELDS X SUP 1 SIGMA (SUP+) SUB g SYSTEM OF THE Mg2 MOLECULE AND ITS J DEPENDENCE [DISKRETE UND KONTINUIERLICHE FRANCK-CONDON-FAKTOREN DES A SUP 1 SIGMA (SUP+) SUB u YIELDS X SUP 1 SIGMA (SUP+) SUB g SYSTEMS DES Mg2-MOLEKUELS UND IHRE J-ABHAENGIGKEIT]
Herbert Scheingraber Oct. 1975 80 p refs In GERMAN
(MFI-PAE/Extraterr-115) Avail: NTIS HC $5.00

Mg molecules were produced in a heat pipe oven and investigated using the method of laser-induced resonance fluorescence. Discrete Franck-Condon factors (FCF) and their J dependency on Mg2 were measured and the results compared with calculations, showing good agreement. It is shown that transition probabilities are different for the P and R lines of a transition. Continuous FCF's were measured and used to determine the near-core part of the basic-state potential curve far beyond the disorientation limit. The temperature dependence of the free-bound-free transitions was measured. Emission lines deriving from the free-bound-bound transitions were identified, compared with the absorption spectrum, and J was determined for some bands from its intensity distribution. ESA

N76-34016# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
COMPLEMENTARY-SYMMETRY/METAL OXIDE SEMICONDUCTOR (CMOS) CIRCUIT HARDENING. VOLUME 1: SILICON-ON-SAPPHIRE (SOS) CMOS CIRCUIT FABRICATION AND CHARACTERIZATION Final Report, Feb. 1973 - Aug. 1974
R. A. Kjar, V. H. Strahan, and J. T. Blandford Jul. 1975 121 p refs 2 Vol.
(Contract F29601-73-C-0055; DNA Proj. NWED-QAXTD043)
(AD-A021643; AFWL-TR-74-243-Vol-1) Avail: NTIS CSCL 20/12

This report summarizes the results of Phase I of a three-phase program to develop and verify hardening techniques in Complementary-Symmetry/Metal Oxide Semiconductor (CMOS) Large Scale Integrated (LSi) circuits fabricated with Silicon-on-Sapphire (SOS) technology. The Phase I study examined, experimentally, the effects of threshold voltage shifts on the electrical performance and transient radiation response in basic CMOS/SOS circuits. Simple CMOS/SOS test circuits, including an inverter, a 2-input NAND gate and a 2-input NOR gate, were fabricated with a 5 x 5-matrix of p-channel and n-channel threshold voltages. Results of electrical measurements are reported which show the variations that can be expected in electrical operation of these circuits, arising from the matrix of threshold voltage combinations. These threshold voltages can result from exposure to ionizing radiation or instability in the gate insulator material. Results of transient radiation measurements are reported which show the transient failure levels that can be expected in CMOS/SOS circuits and the significance of different threshold voltage combinations and sapphire photoresistive effects on the transient radiation hardness. Author (GRA)

N76-34017# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
COMPLEMENTARY-SYMMETRY/METAL OXIDE SEMICONDUCTOR (CMOS) CIRCUIT HARDENING. VOLUME 2: SILICON-ON-SAPPHIRE (SOS) CIRCUIT DESIGN OPTIMIZATION AND RADIATION EFFECT STUDIES Final Report, Feb. 1973 - Aug. 1974
D. H. Phillips and R. K. Pancholy Jul. 1975 265 p refs 2 Vol.
(Contract F29601-73-C-0055; DNA Proj. NWED-QAXD043)
(AD-A021644; AFWL-TR-74-243-Vol-2) Avail: NTIS CSCL 20/12

Responses of silicon-on-sapphire (SOS) circuits to transient radiation have been analyzed--based upon predicted and experimental results from individual transistors and Complementary-Symmetry/Metal Oxide Semiconductor (CMOS) digital SOS integrated circuits. Measured circuit responses match those predicted by sapphire photoconduction theory within experimental accuracy. Since sapphire photoconduction is the limiting transient radiation effect in SOS circuits, mathematical models for this phenomena were developed for the prediction of dose-rate failure thresholds for SOS integrated circuits. These studies concluded that the optimum-geometry approach is the preferred dose-rate radiation hardening method, since it does not involve the disadvantage inherent in the capactive inertia approach (i.e., increased area, lower yield, lower reliability, higher dynamic power dissipation, and slower speed). Results of experiments to investigate the origin of the 'kink' effect (anomalous drain-current characteristics) of n-channel silicon-on-sapphire MOS field-effect transistors (FETs) were analyzed and related to hypothesized physical mechanisms. The experimental data indicate that the characteristics of the base region in MOS FETs are responsible for this anomalous change of 3-terminal electrical characteristics. Author (GRA)

N76-34018# Virginia Univ., Charlottesville. Dept. of Physics.
SUPERCONDUCTING WEAK LINKS Final Report
Bascom S. Deaver, Jr. 15 Mar. 1976 14 p refs
(Contract N00014-69-A-0060-0008; NR Proj. 319-053)
(AD-A022988) Avail: NTIS CSCL 20/12

This report describes the successful formation of superconducting weak link microbridges by ion implantation and investigations of the properties of these devices. The first section sketches the basic physics of superconducting weak links in general. The actual production of the ion implanted weak links is then described, followed by the characterization of the weak links, and a final summary including further work that is being done. GRA

N76-34019# Office of Naval Research, London (England).
HYPERFINE INTERACTIONS INTERNATIONAL
T. A. Kitchens, Jr. 31 Dec. 1975 12 p Conf. held at Leuven, Belgium, Sep. 1975
(AD-A022814; ONRL-C-24-75) Avail: NTIS CSCL 20/12

The following topics are considered: Quadrupole interactions; Magnetic compounds combined magnetic and electric (HI) hyperfine interactions; Muonic atoms and HI with muons; Recoiling nuclei into gases or a vacuum; Electron densities; Nuclear moments; Relaxation effects; Implantation and radiation damage; Magnetic interactions in metals and alloys; Applications of the Mossbauer Effect. GRA

N76-34020# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
EVALUATION OF GALLIUM NITRIDE FOR ACTIVE MICROWAVE DEVICES Annual Report, Apr. 1975 - Mar. 1976
M. Gershenzon Mar. 1976 14 p ref
(Contract N00014-75-C-0295; NR Proj. 243-004; RR0210203)
(AD-A023142) Avail: NTIS CSCL 20/12

At present we can routinely grow large, pure crystals of GaN, but because they are grown and processed under a non-equilibrium NH3 ambient instead of in N2, the maximum growth temperature is limited to 1050 deg. This induces a very high shallow donor density, as well as the precipitation of a second phase. While the latter might be improved by better control of growth parameters, the high carrier density necessitates processing at higher temperatures, where high pressure N2 must be used as the ambient. Furthermore, most normal semiconductor device processing steps can be accomplished only under such conditions. Hence the prime thrust of the efforts this past year

has been in the design and assembly of such a high temperature-high pressure apparatus, and our efforts in CVD (NH3) crystal growth and characterization have been aimed at producing crystals appropriate for high temperature processing (annealing, diffusion, ion implantation and annealing, contacts, junctions). GRA

N76-34021# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
MULTIPHONON RAMAN SCATTERING IN Si AND AlAs
P. B. Klein, Jin-Joo Song, R. K. Chang, and R. H. Callender (City Coll., New York) Mar. 1976 7 p refs Presented at 3d Intern. Conf. on Light Scattering in Solids, Campinas, Brazil, 1975 p 93 Sponsored in part by AF
(Contract N00014-75-C-0866; NR Proj. 396-012)
(AD-A023009; TR-18) Avail: NTIS CSCL 20/12

Resonance Raman scattering in semiconductors with indirect band gaps has been investigated in order to manifest the contribution of the iterative electron-one phonon process to second-order Raman scattering. The authors have searched without success for Raman peaks associated with intervalley scattering among multivalleys. Three- and four-phonon features in Si and AlAs have been observed and are compared with the two-phonon scattering strength. GRA

N76-34022# Westinghouse Research Labs., Pittsburgh, Pa.
THE CRYSTAL GROWTH AND APPLICATION OF SULFOSALT MATERIALS Final Report, 1 Jan. 1974 - 30 Jun. 1975
G. W. Roland, J. D. Feichter, M. Rubenstein, and W. E. Kramer Nov. 1975 135 p refs
(Contract F33615-72-C-1976; ARPA Order 2071)
(AD-A023631; Rept-75-9C4-PHASD-R1; AFML-TR-75-172) Avail: NTIS CSCL 20/2

This report constitutes the Final Technical Report for Contract No. F33615-72-C-1976, Study of Phase Equilibria in the Systems Tl-As-S and Tl-As-Se -Crystal Growth and Application of Sulfosalt Materials. As a result of this program, we now have available extensive knowledge of the ternary melting (liquidus) relations around Tl3PS4 and Tl3PSe4 in the systems Tl-P-S and Tl-P-Se. Optimized crystal growth compositions were determined for Tl3PS4 and Tl3PSe4 and crystal growth from these compositions resulted in remarkably improved optical quality. The optical absorption was reduced to less than 10% of 1/cm. Two successful device applications of new single crystal sulfosalt materials were made. In the first, and potentially most important, Tl3AsSe3 was used in an infrared tunable collinear acousto-optic filter in the 3-5 micrometer region. Operation to 5.3 micrometer was achieved, which is the longest wavelength at which any such device has yet been used. Tl3AsS4 was successfully used as a laser intracavity acousto-optic modulator and Q-switch with low drive power requirements. Technical difficulties believed to be associated with two-photon absorption of pump radiation or with phase matching problems prevented successful operation of a 2.1 micrometer pumped optical parametric oscillator on Tl3AsSe3. Author (GRA)

N76-34023# Colorado State Univ., Fort Collins. Dept. of Physics.
QUANTUM SIZE EFFECTS IN SEMIMETALS AND SEMICONDUCTORS Final Report, 1 Feb. 1975 - 31 Jan. 1976
James R. Sites Jan. 1976 12 p
(Contract N00014-75-C-0770; NR Proj. 372-305)
(AD-A022551; SF8) Avail: NTIS CSCL 20/12

Results have been obtained on the electrical transport properties near the surfaces of InAs and InSb thin films with and without MOS gates. Progress has been made in thinning GaAs epilayers to sub-micron thicknesses. GRA

N76-34024# International Business Machines Corp., Hopewell Junction, N.Y. East Fishkill Lab.
DAMAGE PROFILES IN SILICON AND THEIR IMPACT ON DEVICE RELIABILITY Technical Report, 1 Jul. - 31 Dec. 1975
G. H. Schwuttke Jan. 1976 126 p refs
(Contract DAHC15-72-C-0274; ARPA Order 2196)
(AD-A022756; TR-22.1989; TR-7) Avail: NTIS CSCL 20/12

Impact Sound Stressing of silicon wafers is used to measure the effectiveness of various polishing techniques used to prepare silicon surfaces free of damage. Modern chemical-mechanical polishing techniques such as silicon dioxide and cupric ion polishing are more successful in damage removal than chemical polishing techniques which use mixtures of nitric, hydrofluoric and acetic acids. All polishing techniques are more or less limited in regenerating minority carrier lifetime in mechanically damaged silicon surfaces through surface repolish. Transmission electron microscopy analysis of Hertzian fracture cones and abrasive damage introduced through ISS into (001) silicon surfaces is performed. The analysis is made before and after high temperature oxidation. Dislocation patterns are analyzed before and after oxidation annealing. It is shown that crack stresses in silicon are not relaxed at room temperature. Annealing of dislocation bands produces stacking faults in areas of high density dislocation clusters. The stacking faults are identified as annealing products of microsplits. Finally, it is shown that damage propagation does not occur through the wafer towards the non-stressed surface before or after annealing. GRA

N76-34025# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
TRANSIENT CAPACITANCE MEASUREMENT OF DEEP DEFECT LEVELS IN GaAs AND Si Physical Sciences Research Papers
J. T. Schott, H. M. DeAngelis, and W. R. White 14 Jan. 1976 39 p refs
(AF Proj. 5621)
(AD-A022652; AFCRL-PSRP-655; AFCRL-TR-76-0024) Avail: NTIS CSCL 20/12

An understanding of the defects intentionally or unintentionally introduced in semiconductor crystals by crystal growth or device fabrication procedures or by operation in nuclear and space radiation environments is essential to insure proper performance of electronic and optoelectronic systems. The use of diode capacitance measurement techniques for the study of deep defect levels in semiconductors is discussed, including a recently developed technique based on transient capacitance effects. The theoretical and experimental details of this new technique, involving the use of a lock-in amplifier to process capacitance transients, are presented in appendices. This technique is applied to Schottky barrier and asymmetrical p-n junction diodes of gallium arsenide and silicon, which are primary materials of interest in a variety of device applications. Co60-gamma ray and electron irradiations on unimplanted material produce levels that are similar to some found in the complex defect spectra of ion-damaged samples. GRA

N76-34026# National Bureau of Standards, Washington, D.C. Electronic Technology Div.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: PLANAR TEST STRUCTURES FOR CHARACTERIZING IMPURITIES IN SILICON
M. G. Buehler, J. M. David, R. L. Mattis, W. E. Phillips, and W. R. Thurber Jan. 1976 35 p refs Sponsored in part by DNA and Navy
(ARPA Order 2397)
(PB-250841/4; NBS-SP-400-21; LC-75-619390) Avail: NTIS HC $4.00 CSCL 20L

Various test structures such as sheet resistors, p-n junctions, and MOS capacitors and their associated physical models were developed to characterize dopants and defects in silicon. These structures address various needs within the simiconductor industry for (1) well-designed and miniaturized test structures such as an orthogonal Van der Pauw sheet resistor, (2) simple and economical measurements such as the oxide window width of a diffused layer, (3) updated values for the resistivity versus dopant density relation, and (4) improved detection methods for identifying defect centers which control the lifetime and leakage currents of devices. GRA

N76-34027# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
STANDARD X-RAY DIFFRACTION POWDER PATTERNS: SECTION 13 - DATA FOR 58 SUBSTANCES Interim Report
Marlene C. Morris, Howard F. McMurdie, Eloise H. Evans, Boris Paretzkin, and Johan H. DeGrbot Jun. 1976 117 p refs

(PB-254073/0; NBS-Mono-25-Sect-13; LC-53-61386) Avail: NTIS HC $5.50 CSCL 20B

Standard X-ray diffraction patterns are presented for 58 substances. The experiment X-ray powder diffraction patterns were obtained with an X-ray diffractometer. All d-values were assigned Miller indexes determined by comparison with computed interplanar spacings consistent with space group extinctions. The densities and lattice constants were calculated and the refractive indexes were measured whenever possible. The calculated X-ray powder diffraction patterns were computed from published crystal structure data. Both peak height and integrated intensities are reported for the calculated patterns. GRA

N76-34028# Westinghouse Research Labs., Pittsburgh, Pa.
FLUX QUANTIZATION AND THE JOSEPHSON EFFECT IN EXTREME TYPE 2 SUPERCONDUCTORS Final Report, 1 Apr. 1973 - 31 Dec. 1975
Michael A. Janocko, Clifford K. Jones, and Alexander I. Braginsky Feb. 1976 62 p refs
(Contract N00014-73-C-0315)
(AD-A024635; Rept-76-9C31-SUCON-R1) Avail: NTIS CSCL 20/12

This final report on the three year period of ONR Contract N00014-73-C-0315 gives results on development of fabrication techniques and microwave properties of Nb3Ge and Mo-Re superconductor Josephson junctions. Successful fabrication techniques were devised to make junctions operable at comparatively high cryogenic temperatures. The possibility of using radiation-emitting junctions as a frequency-agile microwave source was examined. Some experimental work on microstrip coupling to Josephson devices was performed. Published reports on high operating temperature junctions and frequency agile sources are included as appendices. Author (GRA)

N76-34029# Southern Methodist Univ., Dallas, Tex. Inst. of Technology.
CHARACTERIZATION AND OPTIMIZATION OF Hg SUB 1-X Cd SUB x Te INFRARED DETECTOR MATERIALS Final Report, 1 Jun. 1972 - 31 Dec. 1974
William F. Leonard Feb. 1976 160 p refs
(Contract F33615-72-C-1818; AF Proj. 2001)
(AD-A023958; AFAL-TR-76-4) Avail: NTIS CSCL 20/12

The objective of this contract was to characterize the ternary compound Hg(1-x)Cd(x)Te. Emphasis was primarily placed on the 0.1 eV composition because of its utility as an intrinsic infrared photoconductor. A distinct advantage of these materials as a photoconductor operating at the longer wavelengths is their high absorption coefficient which allows operation at higher temperatures and also thinner samples. It has been well established that (HgCd)Te can be fabricated with the necessary composition to yield suitable detectors with the desired wavelength response and meeting the basic criteria for intrinsic photoconductors. However, as in the development of any solid state system, the metallurgical surfaces can degrade performance. In the case of (HgCd)Te detectors, the various surface treatments used during fabrication can greatly influence detector performance by changing the electrical and photoconductive properties. For example, treatment wity H2O2 is known to accumulate the surface; whereas, methonalbromine depletes the surface of electrons. Since the noise voltage is greater for a depleted surface than for an accumulated surface, it appears than an accumulated surface is more desirable for photoconductors. In order to better understand the surface and its influence on the bulk properties, the technical effort in this program was divided into three parts: (1) measurement of bulk transport properties utilizing galvanothermomagnetic measurements; (2) determination of surface state distributions from capacitance-voltage (C-V) and capacitive derivative-voltage (C-V) measurements on metal-insulator-semiconductor (MIS) structures, and (3) low frequency (I/f) noise measurement. GRA

N76-34030# Rockwell International Corp., Anaheim, Calif. Missile Systems Div.
EXPLORATORY DEVELOPMENT ON SILICON MATERIAL DEVELOPMENT FOR LADIAR Interim Report, 1 Aug. 1975 - 29 Feb. 1976
M. C. Arst 8 Mar. 1976 50 p refs
(Contract F33615-76-C-5024)
(AD-A023966; C76-233.1/034A) Avail: NTIS CSCL 20/12

The objective of the LADIR program is the development of low cost arrays for the detection of infrared radiation. It is oriented towards the use of silicon in order to utilize the major unique advantage that is made possible by combining detector arrays along with complementary on-chip silicon electronics. This report details the technical considerations and processing steps required for the development of high quality Ga-doped silicon crystals for use in high performance silicon detectors with maximum responsitivity in the 8-14 micrometer spectral region. Specific processing steps include methods to control the quality of purchased material, purification of the starting material, single crystal perfection, control of compensation and well defined control of the gallium dopant in the final product. GRA

N76-34031# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Electrical and Systems Engineering.
TRANSVERSE ACOUSTOELECTRIC VOLTAGE INVERSION AND ITS APPLICATION TO SEMICONDUCTOR SURFACE STUDY: CdS
H. Gilboa and P. Das 29 Mar. 1976 31 p refs
(Contract N00014-75-C-0772; NR Proj. 009-017)
(AD-A024291; MA-ONR-11) Avail: NTIS CSCL 20/12

The transverse acoustoelectric voltage inversion has been observed in CdS. It is found to be due to the inversion of the semiconductor surface. The inversion layer results from a high magnitude of the dc transverse acoustoelectric voltage developed on the semiconductor surface. The acoustoelectric voltage inversion is strongly dependent on the wavelength and intensity of light illuminating the semiconductor surface, and the power input of the SAW. The sub bandgap spectral response of the transverse acoustoelectric voltage determines the positions of the surface states in the energy gap. The above bandgap spectrum determines the photon energy in which transition from bulk to surface absorption takes place and the photon energy for complete surface absorption. Author (GRA)

N76-34032# General Motors Research Labs., Warren, Mich. Dept. of Fuels and Lubricants.
ORIGINS OF INTERFACE STATES AND OXIDE CHARGES GENERATED BY IONIZING RADIATION IN METAL-OXIDE-SILICON STRUCTURES Final Report, 23 Jun. - 22 Dec. 1975
C. T. Sah and L. C. Sah Jan. 1976 70 p refs
(Contract DAAG39-75-C-0164; DNA Proj. NWED-QAXTA007; HDL Proj. 336535)
(AD-A024461; SAHAS-75-2; HDL-CR-76-164-1) Avail: NTIS CSCL 20/12

Evidences are presented to support proposed models of interface states and oxide charges in silicon MOS structures and their interaction with ionizing radiation. Interface states arise from a random distribution of the trivalent silicon centers at the oxide-silicon interface which perturb the silicon conduction and valence band states into the silicon band gap to give the U-shaped surface state density spectra. The positive oxide charges are from both trivalent silicon donor centers and excess oxygen centers. The trivalent silicon centers can be readily neutralized by trace amount of water to form the Si-OH centers which are highly sensitive to ionizing radiation. The Si-OH bond can be broken by ionizing radiation via hole capture or secondary impact ionization. The OH(-) ions freed from the trivalent silicon bonds can readily drift in the high electric field in the oxide of a MOS structure. Process conditions for the generation and annealing of these centers are described. A study is made of the accuracy of interface state density spectra analysis using the high-frequency capacitance-voltage characteristics of MOS capacitors. Single and discrete interface state levels can be resolved by this method. Author (GRA)

N76-34033# California Univ., Los Angeles. School of Engineering and Applied Science.
ANISOTRÓPIC TRANSPORT EFFECTS IN FETS Final Report
James W. Holm-Kennedy and Israel Ury May 1976 24 p refs
(Contract N00014-69-A-0200-4054)
(AD-A023917; UCLA-ENG-7580) Avail: NTIS CSCL 20/12

The project deals with investigations into charge transport

and subbanding in semiconductor FET systems. It has been observed that the transport anisotropy diminishes with decreasing MOSFET inversion density. This is interpreted as a washing-out of the subband structure by the channel width modulating effects of the trapped surface charge and is quantitatively explained in terms of two conductivity contributions, one isotropic and one anisotropic. Subbanding in a J-FET system is treated. Several novel applications of subbanding systems are proposed. GRA

N76-34034# Arcon Corp., Wakefield, Mass.
PERTURBATION METHOD FOR SOLVING THE LINEAR BOLTZMAN EQUATION
John V. OBrien 27 Feb. 1976 111 p refs
(Contract F19628-74-C-0049)
(AD-A023587; AFGL-TR-76-0051; SR-2) Avail: NTIS CSCL 20/12

Two perturbation methods for solving the one dimensional linear steady state Boltzmann equation for slab geometry are considered. These two perturbation methods are the boundary dominated (BD) method and the collision dominated (CD) method. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N76-34035# Loughborough Univ. of Technology (England). Dept. of Mathematics.
THE COLLISION OF PLANE WAVES IN GENERAL RELATIVITY
J. B. Griffiths Feb. 1976 31 p refs
(MATHS-Res-91) Avail: NTIS HC $4.00

A number of exact solutions of Einstein's equations were obtained, which describe the collision and subsequent interaction of two plane parallel waves. Gravitational waves, null electromagnetic fields, and neutrino fields were all considered with collisions between any two types. It is shown that two such waves mutually focus each other with the focus usually appearing as a singularity in space-time. Further conclusions are made regarding the qualitative nature of the interactions, and it is argued that these also apply in more realistic physical situations. Author (ESA)

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N76-34036# Energy Research and Development Administration, Washington, D.C. Buildings and Industry Div.
INTERNATIONAL ENERGY AGENCY WITH EMPHASIS ON THE SUBGROUP ON ENERGY RESEARCH AND DEVELOPMENT AND THE ENERGY CONSERVATION WORKING PARTY
Dec. 1975 38 p refs
(ERDA-76-13) Avail: NTIS HC $4.00

Activities of the Subgroup on Energy Research and Development and the Working Group on Energy Conservation are summarized. These include projects to explore the following: (1) hydrogen from water; (2) waste heat utilization; (3) municipal and industrial waste utilization; (4) coal technology; (5) radioactive waste management; (6) nuclear safety; (7) thermonuclear fusion; (8) solar energy; and (9) energy conservation. The thermal characteristics of buildings, heat pumps, thermal storage, and heat exchangers are also studied. ERA

N76-34037# RAND Corp., Santa Monica, Calif.
THE STUDY, ANALYSIS, AND ADVICE INDUSTRY
John E. Koehler May 1975 39 p refs Presented at Conf. on Expert Advice and Public Choice, Racine, Wisc., 4-6 Apr. 1974
(AD-A022236; P-5433) Avail: NTIS CSCL 05/1

The subject industry is made up of disparate parts: its institutions range from pure social science analysis of urban problems, to hardware-oriented systems engineering, to electronic design for defense systems; from very small to very large organizations; from highly institutionalized to quite short-lived operations. These differences among the constituent firms of the industry are themselves important and deserve some consideration. GRA

N76-34038# Office of Technology Assessment, Washington, D.C.
PROCEEDINGS OF AN ENGINEERING CONFERENCE ON REQUIREMENTS FOR FULFILLING A NATIONAL MATERIALS POLICY
Franklin P. Huddle, ed. Aug. 1974 202 p refs Conf. held at Henniker, New Hampshire, 11-16 Aug. 1974 Prepared in cooperation with Federation of Mater. Soc., Washington, D. C.
(PB-250631/9; OTA-M-4) Avail: NTIS HC $7.75 CSCL 05A

Options for implementing a national materials policy were examined. The following points were stressed (1) the need for reliable and accessible information on all aspects of materials management, (2) the symbiotic relationship of technology economics institutions in implementing national policy, and (3) the interdependence of nations with respect to the production, exchange, and use of materials. Author (GRA)

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N76-34039*+ National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUPERSONIC CRUISE AIRCRAFT RESEARCH (SCAR) PROGRAM BIBLIOGRAPHY, JULY 1972 - JUNE 1976
Sherwood Hoffman Sep. 1976 40 p refs
(NASA-TM-X-73950) Avail: NTIS HC $4.00 CSCL 05B

This bibliography documents 292 publications of the Supersonic Cruise Aircraft Research (SCAR) program published during the first four years of effort. The reports are arranged according to SCAR discipline: system studies, propulsion, stratospheric emissions impact, structures and materials, aerodynamic performance, and stability and control. The specific objective of each discipline is summarized. The publications are listed without abstracts for reference and planning. Author

N76-34040# Oak Ridge National Lab., Tenn.
EARLY PROGRESS OF THE BIOMEDICAL COMPUTING TECHNOLOGY INFORMATION CENTER (BCTIC)
B. F. Maskewitz, R. L. Henne, and W. J. McClain Jan. 1976 10 p ref Presented at the 6th Symp. on the Sharing of Computer Programs and Technol. in Nucl. Med., Atlanta Sponsored by ERDA
(CONF-760119-2) Avail: NTIS HC $3.50

The Biomedical Computing Technology Information Center (BCTIC) forged ahead into the tasks of designing guidelines and procedures, acquisition and packaging of computer codes, data, and interface designs; building a bibliographic data base; and maintaining a directory of the user community. Important contacts

were made with societies and individuals involved in biomedical computing; and BCTIC was publicized through news releases. The response BCTIC has received in its initial months is presented, and a progress report on the developmental phase is given.
Author (ERA)

N76-34041# American National Standards Inst., New York.
PROCEEDINGS OF A SYMPOSIUM ON MANAGEMENT OF DATA ELEMENTS IN INFORMATION PROCESSING (2ND) Final Report
Apr. 1976 263 p refs Held at Gaithersburg, Md., 23-24 Oct. 1975
(PB-249530/7; NBSIR-76-1015) Avail: NTIS HC $9.25 CSCL 09B

Twenty-nine speakers discussed the role of the data manager, communications needs for data standards, data element directories, standard codes for character and control, use of check characters, data elements in bibliographic data bases, product coding, coding for clinical medicine, human factors, data resource management, data base management systems, and other subjects related to data standardization and data management efforts.
Author (GRA)

N76-34042# National Oceanic and Atmospheric Administration, Rockville, Md.
INDEX TO TITLES OF UNION LIST OF SERIALS-1975
1975 706 p Sponsored in part by EPA, Washington, DC, and Patent and Trademark Office, Washington, DC
(PB-253177/0; NOAA-76031702) Avail: NTIS HC $18.75 CSCL 05B

This is an index to serial holdings in a joint listing of the U.S. Environmental Protection Agency, the National Oceanic and Atmospheric Administration and the U.S. Patent and Trademark Office. The index consists of significant words from each of 11,715 titles. It should be useful to identify a title when one knows only a few significant words in the title. It should also be useful to identify several titles in a given subject area. GRA

N76-34043# Louisville Univ., Ky. Urban Studies Center.
SCIENTIFIC AND TECHNICAL INFORMATION SERVICES IN EIGHT LATIN AMERICAN COUNTRIES: DEVELOPMENT TECHNICAL ASSISTANCE OPPORTUNITIES FOR COOPERATION Final Report
Scott Adams Dec. 1975 174 p refs
(Grant NSF SIS-75-14767)
(PB-253202/6) Avail: NTIS HC $6.75 CSCL 05B

Emerging national information systems of Argentina, Brazil, Chile, Peru, Ecuador, Colombia, Venezuela, and Mexico, the technical assistance programs of several national and international agencies, and the self identified needs in the eight countries were reviewed. Following a review of optional assistance strategies, seven recommendations for cooperative action were made.
Author (GRA)

N76-34044# Federal Interagency Field Librarians Workshop, Washington, D. C.
PROCEEDINGS OF THE 1974 ANNUAL FEDERAL INTERAGENCY FIELD LIBRARIANS WORKSHOP (3RD)
Jul. 1975 100 p refs Conf. held at Washington, D. C., 29 Sep. - 4 Oct. 1974 Sponsored in part by Dept. of Commerce, HUD, Corps of Engrs., and Dept. of the Interior
(PB-254087/0; DIOLS-76-07) Avail: NTIS HC $5.00 CSCL 05B

Working sessions reviewed the following subjects: Acquisition, bibliography, reference, and personnel procedures. Among topics presented were: the Federal Library Committee's initiation of a cooperative cataloging agreement between federal libraries and the Ohio College Library Center, problem solving techniques, use of legal materials in federal libraries, bibliographic searching on computerized data bases, and career development. GRA

N76-34045# Forecasting International Ltd., Arlington, Va.
A FORECAST OF TECHNOLOGY FOR THE SCIENTIFIC AND TECHNICAL COMMUNITIES, VOLUMES 1-4 Final Report
Norman Nisenoff and Audrey Clayton May 1976 947 p refs
(Grant NSF GN-42294)
(PB-253937/7) Avail: NTIS HC $23.75 CSCL 05B

The future of scientific and technical communication was analyzed. A unified body of data representing best judgment forecasts of communication system performance, costs and availability for the next 25 years, in conjunction with a parallel of the usage patterns and needs of representative user groups in the S & T community was developed. GRA

N76-34046# Environmental Protection Agency, Washington, D.C. Management Information and Data Systems Div.
ENVIRONMENTAL INFORMATION SYSTEMS DIRECTORY. AN INVENTORY OF ENVIRONMENTAL SYSTEMS
Leonard Libster Jan. 1976 86 p
(PB-251170/7) Avail: NTIS HC $5.00 CSCL 13B

Profile descriptions are given of major automated systems supporting the administrative and environmental-mission operations of the U.S. Environmental Protection Agency. This directory was planned to facilitate such important management objectives as systems planning and coordination, reduction in system costs, and elimination of duplicative systems. It includes all systems for which computer costs are generally greater than $20,000 in FY 1975. GRA

N76-34047# National Library of Medicine, Bethesda, Md.
MEDLARS INDEXING MANUAL. PART 1: BIBLIOGRAPHIC PRINCIPLES AND DESCRIPTIVE INDEXING, 1977
Thelma Charen Jul. 1976 134 p Revised
(PB-254270/2; NLM-MED-76-03-Pt-1) Avail: NTIS HC $6.00 CSCL 05B

General bibliographic principles governing the citation of articles in Index Medicus and other MEDLARS products are described. The form of descriptive indexing of articles and monographs is outlined. The rules apply to procedures to be used beginning with the 1977 Index Medicus. GRA

N76-34048# British Library Lending Div., Boston Spa (England).
MANAGEMENT AND ASSESSMENT OF STOCK CONTROL IN ACADEMIC LIBRARIES
C. Taylor and N. C. Urquhart 1976 156 p refs
(BLL-BLRDR-5263-(2113.56F)) Avail: British Library Lending Div., Boston Spa, Engl.

Large-scale relegation of books from academic libraries was examined and indicators of use and nonuse were developed for general application. It is shown that the relegation of periodicals is considerably less expensive both in terms of investment of effort and space released than the relegation of monographs. A critical approach to current methods of relegating monographs was adopted. Low use theory indicated the economic advantage of block relegation in relation to particular subject areas, followed by selective retrieval where necessary. Closer examination of relegation of individual monographs by past use records revealed that such methods, besides being more expensive, are also misleading. The impact of both overcrowding and the cost of continuous relegation on academic library services was investigated.
Author

N76-34049# British Library Lending Div., Boston Spa (England).
BRITISH LIBRARY WORKING PARTY ON CLASSIFICATION AND INDEXING Final Report
P. R. Lewis Oct. 1975 25 p
(BLL-BLRDR-5233-(2113.56F); ISBN-0-85350-133-5) Avail: British Library Lending Div., Boston Spa, Engl.: £.2 or $4.00

Classification and indexing systems are reviewed. It is recommended that the PRECIS system of subject indexing and the Dewey Decimal Classification system be adopted for use in the Reference Division of the British Library. J.M.S.

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N76-34050# Battelle Pacific Northwest Labs., Richland, Wash.
ECONOMIC ANALYSIS OF GEOTHERMAL ENERGY COSTS
C. H. Bloomster 1975 33 p refs Presented at 68th Ann. Meeting of Am. Inst. of Chem. Engr., Los Angeles, 16 Nov. 1975

(Contract E(45-1)-1830)
(BNWL-SA-5596; Conf-751107-17) Avail: NTIS HC $4.00

A description is given of the computer program, GEOCOST, and its application to some analyses of the economics of geothermal energy. GEOCOST combines both technical and economic factors into one systematic cost accounting framework. The program, which simulates production of electricity from most types of geothermal resources, is composed of two parts: a reservoir model which simulates the costs associated with the exploration, development, and operation of a geothermal reservoir; and a power plant model which simulates the costs associated with the design, construction, and operation of the power plant. The costs from the reservoir model become the energy supply costs to the power plant. The combined reservoir and power plant models represent the complete energy production system.
Author (ERA)

N76-34051# Bernard Baruch Coll., New York. Dept. of Finance and Economics.
ESTIMATION OF THE COST OF CAPITAL FOR MAJOR UNITED STATES INDUSTRIES WITH APPLICATION TO POLLUTION CONTROL INVESTMENTS
Gerald A. Pogue Nov. 1975 256 p refs
(Contract EPA-68-01-2848)
(PB-251178/0; EPA-230/3-76-001) Avail: NTIS HC $9.00 CSCL 05C

Estimates of historical and current costs of equity and total capital faced by firms of six major U.S. industries were studied. In estimating equity costs, traditional DCF and the capital asset pricing model approaches were used. The estimates were extrapolated into the future, under the assumption that future values will reflect an average of past risk premiums, and a methodology specified that can be used to measure the financial impact on firms of investments in pollution control equipment.
Author (GRA)

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N76-34052*# Denver Research Inst., Colo. Industrial Economics Div.
SPACE BENEFITS: THE SECONDARY APPLICATION OF AEROSPACE TECHNOLOGY IN OTHER SECTORS OF THE ECONOMY NASA Benefits Briefing Notebook
1976 190 p refs
(Contract NASw-2607)
(NASA-CR-148810; DRI-76-2) Avail: NTIS HC $7.50 CSCL 05C

A 'Benefit Briefing Notebook' was prepared for the NASA Technology Utilization Office to provide accurate, convenient, and integrated resource information on the transfer of aerospace technology to other sectors of the U.S. economy. The contents are divided into three sections: (1) transfer overview, (2) benefit cases, and (3) indexes. The transfer overview section provides a general perspective for technology transfer from NASA to other organizations. In addition to a description of the basic transfer modes, the selection criteria for notebook examples and the kinds of benefit data they contain are also presented. The benefits section is subdivided into nineteen subject areas. Each subsection presents one or more key issues of current interest, with discrete transfer cases related to each key issue. Additional transfer examples relevant to each subject area are then presented. Pertinent transfer data are given at the end of each example.
Author

N76-34053# Committee on Aeronautical and Space Sciences (U. S. Senate).
SPACE BENEFITS: THE SECONDARY APPLICATION OF AEROSPACE TECHNOLOGY IN OTHER SECTORS OF THE ECONOMY
Washington GPO 1975 57 p Rept. for Comm. on Aeron. and Space Sci., 94th Congr., 1st Sess., 16 Apr. 1975
(GPO-48-713) Avail: Comm. on Aeron. and Space Sci.

Short summaries of a few well documented examples of technology transfer from NASA programs to other fields are given. Some of the cases cited included: manufacturing consumer goods, manufacturing capital goods, environmental quality, food production and processing, construction, law enforcement, highway transportation, petroleum and gas, new consumer products and retailing, and electric utilities.
Author

N76-34054# National Science Foundation, Washington, D.C. Office of National Research and Development Assessment.
FEDERAL TECHNOLOGY TRANSFER. AN ANALYSIS OF CURRENT PROGRAM CHARACTERISTICS AND PRACTICES
J. David Roessner Dec. 1975 38 p refs 3 Vol.
(PB-253104/4; NSF/RDA-76-400) Avail: NTIS HC $4.00 CSCL 05A

The results of an analysis of the technology transfer and research utilization activities of 25 Federal departments and agencies are analyzed. The study's objectives were: to suggest ways in which transfer and utilization programs can be assessed and improved; to identify factors likely to be associated with effective program performance; and to describe systematically current Federal transfer and utilization programs.
GRA

N76-34055# National Science Foundation, Washington, D.C. Office of National Research and Development Assessment.
FEDERAL TECHNOLOGY TRANSFER. AN ANALYSIS OF CURRENT PROGRAM CHARACTERISTICS AND PRACTICES
J. David Roessner Dec. 1975 10 p refs 3 Vol.
(PB-253105/1; NSF/RDA-76-401) Avail: NTIS HC $3.50 CSCL 05A

The results of an analysis of the technology transfer and research utilization activities of 25 Federal departments and agencies were summarized. This information is addressed to Federal policymakers responsible for designing, developing, operating, or assessing formal technology transfer and research utilization programs.
GRA

N76-34056# RAND Corp., Santa Monica, Calif.
ANALYSIS OF FEDERALLY FUNDED DEMONSTRATION PROJECTS. VOLUME 1: EXECUTIVE SUMMARY Final Report
Walter S. Baer, Leland L. Johnson, and Edward W. Merrow Apr. 1976 34 p
(Contract NBS-4-35959)
(PB-253108/5; NBS-GCR-ETIP-76-05) Avail: NTIS HC $4.00 CSCL 05A

The purposes of the federally funded demonstration projects study are: (1) to identify major factors associated with successful and with unsuccessful project outcomes, and (2) to formulate guidelines for federal agencies in improving the planning, implementation, monitoring, evaluation, and dissemination of results of future demonstration projects.
GRA

N76-34057# Massachusetts Inst. of Tech., Cambridge. Center for Policy Alternatives.
NATIONAL SUPPORT FOR SCIENCE AND TECHNOLOGY: AN EXAMINATION OF FOREIGN EXPERIENCE, SUMMARY Final Report
Nicholas A. Ashford 15 May 1976 148 p refs 2 Vol.

(Grant NSF RDA-73-07228)
(PB-253295/0; CPA-75-12/S; NSF/RDA-73/5/1) Avail: NTIS HC $6.00 CSCL 05A

The instruments of government policy by which technological change is influenced in France, West Germany, the Netherlands, the United Kingdom and Japan were examined and evaluated. Since most of the industrialized nations have implemented programs concerned with technological innovation, an examination of the foreign experience should be included in any attempt to design U.S. policy for stimulating or directing technology innovation. This is likely to be useful even in the absence of explicit national innovation policy in the countries to be studied. GRA

N76-34058# Massachusetts Inst. of Tech., Cambridge. Center for Policy Alternatives.
NATIONAL SUPPORT FOR SCIENCE AND TECHNOLOGY: AN EXAMINATION OF FOREIGN EXPERIENCE Final Report
Nicholas A. Ashford 15 May 1976 958 p refs 2 Vol.
(Grant NSF RDA-73-07228)
(PB-253296/8; CPA-75-12-Vol-1; NSF/RDA-73/5/2) Avail: NTIS HC $23.75 CSCL 05A

A comparative analysis was made across five countries (France, Germany, the Netherlands, the United Kingdom and Japan) of the ways in which governments influence technological change. This influence operates through government instruments designed or intended to affect (1) the innovation process, (2) the intellectual resource base, and (3) the adverse consequences of technology such as deterioration of the environment and labor's resistance to technological change. GRA

N76-34059# RAND Corp., Santa Monica, Calif.
ASSESSING TECHNOLOGY ASSESSMENT
William F. Hederman, Jr. Feb. 1975 41 p refs
(AD-A022224; P-5391) Avail: NTIS CSCL 05/1

Technology assessment is being proposed as a tool for the policymaker, so it must address real policy issues with any available data and theory, in time to be considered when the policy decision is made. This paper evaluates some examined assessments.GRA

N76-34060# King Research, Inc., Rockville, Md. Center for Quantitative Sciences.
STATISTICAL INDICATORS OF SCIENTIFIC AND TECHNICAL COMMUNICATION (1960-1980). VOLUME 2: A RESEARCH REPORT Final Report
D. W. King, F. W. Lancaster, D. D. McDonald, N. K. Roderer, and B. L. Wood May 1976 505 p refs
(Contract NSF C-878)
(PB-254060/7; KRI-9212-2-Vol-2) Avail: NTIS HC $12.75 CSCL 05B

The data, framework, and mathematical models used to generate the statistical indicators dealing with the formal scientific and technical literature, such as books, journal articles, technical reports, etc. are described. A bibliography and appendices describing the methodology are included. GRA

N76-34061# Urban Inst., Washington, D.C.
INDUSTRIAL AND ECONOMIC IMPACTS OF IMPROVING AUTOMOBILE FUEL EFFECIENCY: AN INPUT/OUTPUT ANALYSIS
Melvyn D. Cheslow Apr. 1976 85 p refs
(Grant NSF GI-40615)
(PB-253448/5; UI-1216-3-2) Avail: NTIS HC $5.00 CSCL 13F

Three alternatives which could improve automobile fuel efficiency were examined. Two involved reducing vehicle weight by replacing iron and steel with lighter weight aluminum or plastic. The third would change the mix of car sizes so that more small, light weight vehicles are produced. Major emphasis was on describing potential automobile design changes for each of the alternatives and on analyzing several aspects of the interindustry and macroeconomic impacts. Industry output and employment changes were examined using an input/output model. Changes in output from the energy industries for each of the alternatives were analyzed. Author (GRA)

N76-34062# Oak Ridge National Lab., Tenn.
CROSS-FLOW FILTRATION IN PHYSICAL-CHEMICAL TREATMENT OF MUNICIPAL SEWAGE EFFLUENTS Final Report, 1970 - 1975
H. A. Mahlman, W. G. Sisson, K. A. Kraus, and J. S. Johnson Feb. 1976 127 p refs
(Contracts W-7405-eng-26; DI-14-12-832)
(PB-253443/6; ORNL-TM-5423; EPA-600/2-76-025) Avail: NTIS HC $6.00 CSCL 13B

Cross flow filtration was tested for separation of water from the effluent of primary or secondary treatment of municipal sewage, after addition of physical chemical reagents. In this approach, the solution being filtered was pumped parallel to the filter, to slow buildup of flux limiting filtercake. In most cases, the filtering surfaces were 1 inch fabric tubes, manufactured as fire hose jackets. Results were presented as functions of pressure, water recovery, circulation velocity, additive concentration and other variables. Author (GRA)

N76-34063# Ultrasystems, Inc., Phoenix, Ariz. Dynamic Science Div.
AUTOMOBILE CONSUMER INFORMATION STUDY CRASH TEST PROGRAM. VOLUME 1: SUMMARY REPORT Final Report, Jun. 1974 - Dec. 1975
Richard W. Carr Apr. 1976 26 p refs
(Contract DOT-HS-4-00909)
(PB-252426/2; DOT-HS-801-875; Rept-8268-75-190) Avail: NTIS HC $4.00 CSCL 13F

Test methodology for a series of vehicle rating tests was developed to produce a data base for use in determining crashworthiness and damage susceptibility ratings for contemporary automobiles. The crash test program was conducted over a 15-1/2 month period and was divided into two phases. The Phase I requirements were for ten crash tests of two 1973 intermediate size automobiles. These tests included rigid barrier, moving barrier, and car to car impacts, at speeds ranging from 15 to 30 mph. Phase II involved twelve crash tests of the comparable 1974 intermediate size automobiles. These tests included only rigid barrier, frontal impacts, and car to car front to rear impacts at speeds ranging from 8 to 35 mph. Author (GRA)

N76-34064# Texas Engineering Experiment Station, College Station. Industrial Economics Research Div.
COST-EFFICIENT CARGO DISTRIBUTION AMONG TRANSPORTATION MODES
Christian Phillips Mar. 1976 87 p refs
(Grant NOAA-04-3-158-18)
(PB-253969/0; TAMU-SG-76-206; NOAA-76050301) Avail: NTIS HC $5.00 CSCL 13B

The present method of distributing chemicals, fuel and lubricants, and primary iron and steel products between certain locations was discussed as inefficient. A linear programming (LP) method was formulated to minimize the total cost of distributing a given volume of commodities among given locations. Since rail, truck, and barge modes were considered, the locations included in the model were accessible by all three transportation modes. The five cities involved were Corpus Christi, Houston, Beaumont/Port Arhtur, New Orleans, and St. Louis. Certain simplifying assumptions were specified to allow the model to work. Author (GRA)

N76-34065# Transportation Research Board, Washington, D.C.
PUBLIC TRANSPORTATION PLANNING
1976 101 p refs
(PB-253714/0; TRB/TRR-563; ISBN-0-309-02473-0) Avail: NTIS HC $5.50 CSCL 13B

Research and development efforts are reported for the following topics: (1) urban public transportation goal determination a research approach; (2) legislative perspectives on the state transportation planning process and transit planning in California; (3) consumer attitudes toward public transit; (4) characteristics, attitudes, and perceptions of transit nonusers in the Atlanta region; (5) travel patterns on a new regional rapid transit system--clues from the early stages of operations on BART; (6) forecasting dial-a-bus ridership in small urban areas; (7) forecasting demand for peripheral park-and-ride service; (8) public policy and transit services for handicapped persons; (9) evaluating the relevance

of specialized university courses in public transportation; and (10) operational planning of fixed route and demand responsive bus systems in the greater Lafayette, Indiana, area. GRA

N76-34066# Nassau County Multi-Municipal Productivity Project, Mineola, N. Y.
AN APPROACH TO PRODUCTIVITY IMPROVEMENT IN THE PUBLIC SECTOR: A PROCEDURAL MANUAL Final Report, Nov. 1972 - Jul. 1975
Jul. 1975 110 p refs
(Contract L-74-74)
(PB-253645/6; ASPER/CON-74/0074/A) Avail: NTIS HC $5.50 CSCL 05A

The major premise of the approach contained in this procedural manual is that productivity of municipal services is measurable and can be improved through systems analysis by trained analysts. The approach assumes that productivity improvement must have the support of the elected public and union officials and can best be achieved through employee participation. Objective data on employee attitudes for productivity improvements are required, and the process of gathering the data is described. The public should be made aware of the benefits of productivity improvement. A program for communication of program goals and objectives to all participants, which is considered essential, is described. GRA

N76-34067# Pennsylvania Transportation Inst., University Park.
THE ROLE OF SUBSTATE REGIONS IN TRANSPORTATION PLANNING, PROGRAMMING, AND BUDGETING Summary Report, 1 Jul. 1974 - 15 Dec. 1975
Thomas D. Larson, I. Hand, and T. H. Poister Sep. 1975 55 p Sponsored by the Pa. State Dept. of Transportation and FHA, Washington, D.C.
(PB-251060/0; PTI-7517) Avail: NTIS HC $4.50; HC also available in set of 3 reports as PB-251059-SET, HC $20.00 CSCL 13B

Alternative concepts for substate regions and regional organizations in Pennsylvania as a basis for transportation planning, programming, and budgeting were formulated, and the preparation of draft legislation dealing with substate regionalism in Pennsylvania was discussed. Major recommendations of the research indicated that: (1) a Regional Planning and Development Council (RPDC) should be established in each substate region; (2) legislation implementing the RPDCs should be of a general comprehensive nature; and (3) certain transportation planning functions should be delegated to an RPDC by PennDOT through a cooperative agreement. Author (GRA)

N76-34068# Logistics Management Inst., Washington, D.C.
LOGISTICS AND ECONOMIC FACTORS AFFECTING THE RECYCLING OF WASTE MATERIAL AND BY-PRODUCTS. PROJECT 8: MEASUREMENT AND DESCRIPTION OF THE DOD SOLID WASTE PROBLEM Interim Report
H. J. Boisseau, Jr. Mar. 1976 110 p refs Sponsored by Dept. of Defense
(AD-A023605; LMI-74-12) Avail: NTIS CSCL 13/2

The objective of this study is to design, test and implement a solid waste sampling plan for DoD installations which will generate usable information on solid waste generation, recovery and disposal by individual installations, commands, military services/DoD agencies and for the DoD as a whole. This interim report covers the first stage of the study. It primarily is concerned with the development and selection of alternative solid waste sampling plans for DoD installations. The scope is limited to acquiring data on the quantity, volume, (weight) composition and emission variables of the solid waste generated, recovered and disposed by the various activities of the installations. GRA

N76-34069# Lockheed Missiles and Space Co., Sunnyvale, Calif.
A STUDY TO EVALUATE THE FEASIBILITY OF WET OXIDATION FOR SHIPBOARD WASTE WATER TREATMENT APPLICATION Final Report
R. B. Jagow Sep. 1975 189 p refs
(Contract DOT-CG-23034-A)
(AD-A022854; USCG-D-189-75) Avail: NTIS

The feasibility of applying wet oxidation to solve the problem of shipboard waste treatment on board a 20 man Coast Guard vessel was investigated by designing, building and testing a breadboard wet oxidation system using a non-stirred packed tower reactor. Initial tests in the tower reactor indicated favorable results but lead to catalyst screening tests in a one gallon stirred reactor. The selected catalyst was tested in a one liter packed tower and finally in the full scale breadboard system. Final process conditions were selected and the preliminary design of a shipboard system was developed. Additionally, chemical oxygen sources were investigated as a means of simplifying the system hardware and eliminating the catalyst. Results were promising. Plastic model flow tests were conducted on a variety of tube configurations. A four tube reactor design was then fabricated and tested with and without chemical oxygen sources. Author (GRA)

N76-34070# Public Technology, Inc., Washington, D.C.
URBAN TECHNOLOGY SYSTEM (UTS)
16 Jan. 1976 75 p refs
(Contract NSF C-834)
(PB-252984/0; NSF/RA-760034) Avail: NTIS HC $4.50 CSCL 13B

The Urban Technology System (UTS) is a nationwide experiment to test methods of overcoming barriers to local government technological innovation. The UTS has assigned engineers and scientists called 'technology agents' to 27 local governments, and provided them with technical support from major research and development organizations. The technology agents work directly with their respective local government chief administrative officers and are exploring solutions to a wide range of local problems. After 29 months of operation, nearly $6.3 million in annual/anticipated savings was demonstrated. Specific quantitative and qualitative benefits of the program achieved to date are discussed. GRA

N76-34071# Texas Transportation Inst., College Station.
THE MEASUREMENT OF PILE DRIVING FORCES AND ITS APPLICATION TO WAVE EQUATION ANALYSIS OF PILES Final Report, Sep. 1974 - Sep. 1975
Francis X. Kaiser, Jr., Harry M. Coyle, Lionel J. Milberger, and Richard E. Bartoskewitz Sep. 1975 146 p refs
(PB-251964/3; TTI-2-5-75-195-1F) Avail: NTIS HC $6.00 CSCL 13B

A dynamic peak force readout device was tested and found to be accurate, reliable, and easily used with a proposed method of analysis of driven piles. Model pile, pile stub in a pendulum loading facility, and actual field pile driving tests are described. The data from the tests are presented for the device and for a standard carrier amplified system used during the tests. Comparison of the output data shows that the device measures peak force values which are within 4% of the values obtained with the standard carrier amplifier system. Tests conducted under various temperature conditions demonstrate the stability of the device. GRA

N76-34072# Office of Technology Assessment, Washington, D.C.
ANNUAL REPORT TO THE CONGRESS, 15 MARCH 1976
15 Mar. 1976 101 p refs
(PB-253989/8) Avail: NTIS HC $5.50 CSCL 05A

The activities are summarized of the Office of Technology Assessment. A brief description of the organization and operations is given as well as a description of projects underway or projected in each of the following program areas: energy, food, health, materials, national research and development policies and priorities, oceans, and transportation. GRA

N76-34073# RAND Corp., Santa Monica, Calif.
ANALYSIS OF FEDERALLY FUNDED DEMONSTRATION PROJECTS, VOLUME 2 Final Report
Walter S. Baer, Leland L. Johnson, and Edward W. Merrow Apr. 1976 197 p refs
(Contract NBS-4-35959)
(PB-253918/7; NBS-GCR-ETIP-76-06-Vol-2) Avail: NTIS HC $7.50 CSCL 05A

A study was conducted to develop cost benefit and market/industrial/institutional criteria and guidelines for the use of federally procured demonstration projects as catalysts for technological change. Guidelines for demonstration projects were developed and are grouped under the headings of (1) Strategies

for demonstrations, (2) Initial exploratory study, (3) Project planning and implementation, (4) Management, monitoring, and evaluation, and (5) Dissemination of results. A detailed final report is provided. GRA

N76-34074# Transportation Research Board, Washington, D.C.
TRAFFIC FLOW THEORY AND APPLICATIONS
David W. Cravens 1976 103 p refs
(PB-253715/7; TRB/TRR-567; ISBN-0-309-02480-3) Avail: NTIS HC $8.00 CSCL 13B

Single- and two-regime traffic flow models, a deterministic traffic flow model for the two-regime approach, and traffic performance models are presented. Applications of traffic flow theory in modeling network operations are discussed along with first year effects of the energy crisis on rural highway traffic, driver response to the 55-mph maximum speed limit, and variational characteristics of spot speeds. J.M.S.

N76-34075# California Univ., Davis. Water Resources Center.
RESIDENTIAL WATER CONSERVATION
Murray Milne Mar. 1976 471 p refs Sponsored by Dept. of Interior
(PB-253253/9; UCAL-WRC-W-424; W76-08103; OWRT-A-048-CAL(1); Rept-35) Avail: NTIS HC $12.00 CSCL 13B

A 'typical' residential consumption profile is presented, along with a brief history of how water is used in the home. Over four dozen commercially available devices which affect water consumption in the home are evaluated. In an attempt to discover future trends, a survey was made of the relevant aerospace technology, including Apollo and Skylab systems, as well as the systems installed in commercial jet aircraft, trains, and ships. Recent patent applications were searched and dozens of new water conserving fixtures and appliances were discovered. Scenarios are laid out to show the homeowner different strategies for reducing water consumption. GRA

N76-34076# California Univ., Irvine. Urban Information Systems Research Group.
TECHNOLOGICAL INNOVATION IN LOCAL GOVERNMENT: THE CASE OF COMPUTERS IN US CITIES AND COUNTIES
James N. Danziger and William H. Dutton Mar. 1976 56 p refs
(Grants NSF APR-74-12158-A01; NSF APR-74-12158-A02) (PB-250360/1; WP-76-12; NSF/RA-760110) Avail: NTIS HC $4.50 CSCL 05A

A growing body of theory and research focuses on the characteristics of innovative organizations and the diffusion of innovation. The determinants are analyzed of one of the most widespread technological innovations utilized by local governments: computers and electronic data processing (EDP). Currently, there is little systematic evidence about the factors which affect the level at which local governments adopt this innovation. Employing the response data from most larger American cities and counties, an index of 'EDP innovation' is constructed. GRA

N76-34077# Texas Transportation Inst., College Station.
URBAN TRAFFIC OPERATIONS TRAINING PROGRAM Final Report, 22 Jun. 1974 - 29 Feb. 1976
N. J. Rowan, D. L. Woods, and V. G. Stover 29 Feb. 1976 106 p refs
(Contract DOT-FH-11-8510)
(PB-251175/6; RF-3111-2) Avail: NTIS HC $5.50 CSCL 05I

A three level program concept structured to the needs of management, supervisory and technical levels of urban transportation was presented. Recommendations were discussed for nine courses at the supervisory level. Details such as scope training objective and course outlines were included. Recommendations for major subject areas and course topics for the technical level were presented. Author (GRA)

N76-34078# Georgia Univ., Athens. Environmental Resources Center.
IMPLICATIONS OF ZONING AS AN URBAN WATER MANAGEMENT MEASURE
Charles F. Floyd and Michael J. Rowan Mar. 1976 114 p refs Sponsored in part by Ga. Inst. of Tech.
(Contract DI-14-31-0001-4153)
(PB-253769/4; ERC-0576; W76-08755; OWRT-B-094-GA(2)) Avail: NTIS HC $5.50 CSCL 13B

The data base of the Georgia Transportation Planning Land Use model was improved regarding existing land use and suitability of land for development. This model was developed to assist in analyzing the non user impacts of transportation facility improvements along rural and semi-rural corridors. The land use submodel was modified for analyzing the impact of transportation facility improvements on land use change. The model was used to analyze the impact of restrictive land use policies on economic development and land use. GRA

N76-34079# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
CRITERIA FOR EVALUATING ALTERNATIVE TRANSIT STATION DESIGNS Final Interim Report, Aug - Dec. 1975
Lester A. Hoel, Michael J. Demetsky, and Mark R. Virkler Feb. 1976 62 p refs
(Contract DOT-OS-50233)
(PB-253742/1; RLES-CE-4142-101-76; DOT/TST-76/68) Avail: NTIS HC $4.50 CSCL 13F

The urban transit interchange facility is described in terms of the important functional facility components and the quality of the station environment. These terminal dimensions are interpreted to establish a list of design objectives which reflect the points of view of the user, the special user (elderly and handicapped), and the operator. A general evaluation is derived and compared with the basic systems evaluation procedures: effectiveness analysis, benefit cost analysis, and ranking and rating models. GRA

88 SPACE SCIENCES (GENERAL)

N76-34080# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMER 378. PART 2: (COMPREHENSIVE REPORTS). DATA FOR AUGUST 1975 - JULY 1975 AND MISCELLANEA. EXPLANATION OF DATA REPORTS ISSUED AS NUMBER 366 (SUPPLEMENT) FEBRUARY 1975
Hope I. Leighton Feb. 1976 62 p refs
(PB-247137-378-2; SGD-378-Pt-2; NOAA-76031802-Pt-2) Avail: NTIS MF $2.25; HC available from National Climatic Center. Attn: Publications. Federal Bldg., Asheville, N. C. 28891. Subscription $34.00/year includes Part 1 (Prompt Reports) and Part 2 (Comprehensive Reports); $18.00/year for either part. Annual supplement containing explanation is included. $1.50/copy for either part; $1.40 for the extra issue CSCL 03B

Data includes sections on: solar flares, solar radio waves, and magnetograms of geomagnetic storms. The July 1975 data includes a revised hydrogen alpha synoptic chart, an abbreviated calendar record, and a regional flare index. GRA

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N76-34081# Lund Observatory (Sweden).
MEASUREMENTS IN STELLAR SPECTRA: LECTURES AT THE LUND OBSERVATORY NORDIC SUMMER SCHOOL 1975
A. Ardeberg, G. Larsson-Leander, G. Lynga, D. Dravins, and J. Andersen 1975 263 p refs
(Rept-5) Avail: NTIS HC $9.00

Transcripts of five lecture series given during the 1975 summer are given. These deal with the following subjects:

measurement of stellar continuous spectra, measurement of spectral lines, automatic evaluation methods, instrument profiles in stellar spectrographs, and modern spectrograph design.Author

N76-34082# Lund Observatory (Sweden).
COMPUTER PROGRAMS FOR THE DETERMINATION OF PHOTOMETRIC ELEMENTS FOR ECLIPSING BINARIES
Staffan Soederhjelm Mar. 1976 20 p refs
(Rept-10) Avail: NTIS HC $3.50

A brief description and complete Algol listings of two computer programs that calculate photometric elements for eclipsing binaries are given. They are based on Kopal's analytical theory for the light changes, and require much shorter computing times than purely numerical schemes of comparable accuracy. Author

N76-34083*# Joint Publications Research Service, Arlington, Va.
NEW METHODS OF ASTRONOMY
N. S. Blinov Washington NASA Aug. 1976 12 p Transl. into ENGLISH from Priroda (USSR) no. 7, Jul. 1976 p 112-119
(NASA Order W-13183)
(NASA-TT-F-17184) Avail: NTIS HC $3.50 CSCL 03A

The lag of accuracy in astrometrical observation based on optical methods was demonstrated, and the potential of methods based on new principles (long-base radiointerferometers, laser range finders, optical gyroscopes) to restore astrometry's part in time service, latitude service and earth pole movement observations is examined. Doppler-shift satellite observations in the U.S. are used as an illustration of these new methods. Author

N76-34084*# Planetary Science Inst., Tucson, Ariz.
ASTEROIDAL AND PLANETARY ANALYSIS Final Report
William K. Hartmann 11 Sep. 1975 163 p refs
(NASw-2718)
(NASA-CR-147983) Avail: NTIS HC $6.75 CSCL 03A

Photometric, spectrophotometric, and radiometric investigations of asteroids and planets are reported. Profiles of the planetary disk were used to study the physical structure of the Uranus atmosphere, and thermal and photographic properties of Saturn rings were theoretically modelled. Ground-based Mars observations were made for long-term comparison with Mariner 9 results. A.R.H.

N76-34085# California Univ., Livermore. Lawrence Livermore Lab.
POSTERIORI RESTORATION OF ATMOSPHERICALLY DEGRADED IMAGES USING MULTIFRAME IMAGERY
J. W. Sherman 15 Jan. 1976 12 p refs Presented at the Topical Meeting on Image Process., Pacific Grove, Calif., 24 Feb. 1976
(Contract W-7405-eng-48)
(UCRL-77403; Conf-760206-2) Avail: NTIS HC $3.50

A signal processing method for the A posteriori restoration of atmospherically degraded images is developed. The emphasis is on near optimal processing of the measurements so that the images are restored without enhancing the unwanted noise effects. Short exposure images are used to freeze the motion caused by atmospheric turbulence. Multiframe imagery is used to obtain first and second order statistics of the degraded images. The integral equations relating the measured statistics to the underlying object and atmospheric characteristics are derived. A multi step process is developed for solving these integral equations. An estimate of the Cartesian product of the object with itself is obtained from the second order statistics using Fourier methods. An estimate of the object is then derived from an eigen expansion of the Cartesian product. This estimate is augmented by an estimate from the first order statistics. The performance of this restoration method is illustrated by simulation results.
Author (ERA)

N76-34086# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
POSITIONING MEASUREMENTS FOR THE 34m PARABOLIC ANTENNA WERTHHOVEN USING RADIO STARS [POSITIONIERUNGSMESSUNGEN FUER DIE 34-m-PARABOLANTENNE WERTHHOVEN MIT HILFE VON RADIOSTERNEN]
O. Schmid Dec. 1975 44 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(Rept-5-75) Avail: NTIS HC $4.00

Operating antennas of high directivity requires the exact knowledge of the difference between the direction of the antenna beam center and the direction indicated by the readout devices. This difference can be measured by radio stars and used for calibrating the position encoders. A method was developed for obtaining antenna position errors. The antenna was scanned across numerous points of the radio star trajectory. Misalignment was provided by a computer program. The measurements were performed with the 34-m-paraboloid antenna Werthhoven; Cassiopeia A was used as radio source. Considering numerous sources of errors, including the errors of radio star coordinates, pointing-error diagrams were obtained for azimuth angles between approximately 305 and 55 deg, respectively, elevation angles between approxiamtely 20 and 82 deg with an rms of approximately 0.002 deg. Author (ESA)

N76-34087# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
A COMPARISON BETWEEN THE TWO MICRON SKY SURVEY AND THE CELESCOPE CATALOG OF ULTRAVIOLET OBSERVATIONS. A PROPOSAL FOR INFRARED OBSERVATIONS
L. Rossi Mar. 1975 34 p refs
(LPS-75-5) Avail: NTIS HC $4.00

There are 48 objects in common between the two catalogues. Some of them seem very suitable for IR observations at wavelengths longer than 2 microns. A proposal for IR observations was carried out from the correlation of the two catalogues. Author (ESA)

N76-34088# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
PHOTOMETRY AND ANALYSIS OF THE SHORT PERIOD VARIABILITY OF THE NOVA CYGNI 1975
M. Marcocci (Lab. di Astrofis. Spaziale), I. Mazzitelli (Lab. di Astrofis. Spaziale), R. Messi (Lab. di Astrofis. Spaziale), G. Natali (Lab. di Astrofis. Spaziale), and L. Rossi Apr. 1976 23 p refs Submitted for publication
(LPS-76-11) Avail: NTIS HC $3.50

The UBVRI photoelectric photometry of Nova Cygni 1975 from September 1st to December 3rd is reported. Some observational features are discussed, together with some physical parameters of the binary system. An attempt to derive a theoretical model was made. Author (ESA)

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N76-34089*# Scientific Translation Service, Santa Barbara, Calif.
THE EFFECTS OF THE HAWKING PROCESS ON THE BOUNDARY OF AND INSIDE A BLACK HOLE
I. D. Novikov Washington NASA Oct. 1976 12 p refs Transl. into ENGLISH of "Effekty Protsessa Khoukinga na Granitse i Vnutri Chernoy Dyry" Rept. Pr-268, Moscow, Inst. of Space Res., Acad. of Sci. USSR, 1976 p 1-12
(Contract NASw-2791)
(NASA-TT-F-17234) Avail: NTIS HC $3.50 CSCL 03B

The consequences of particle creation and vacuum polarization within and near a black hole were analyzed. The restrictions on the components of the stress-energy tensor of real heavy particles near Tau sub g for a black hole in thermal equilibrium with external radiation were obtained. The calculations which were performed in Kruskal spacetime without matter (which does not take into account the back influence of this process on the metric and gives nonzero energy flux from a black hole) are shown to be not self-consistent. Author

N76-34090*# Kanner (Leo) Associates, Redwood City, Calif.
LONG-PERIOD TERMS IN THE SOLAR SYSTEM
P. Bretagnon Washington NASA Oct. 1976 32 p refs Transl. into ENGLISH from Astron. Astrophys. (West Germany),

v. 30, no. 1, Jan. 1974 p 141-154
(Contract NASw-2790)
(NASA-TT-F-17239) Avail: NTIS HC $4.00 CSCL 03B

The long period variations of the eight planets of the solar system (excluding Pluto) were studied. The Lagrange solution was first calculated, and the long period terms of fourth order in eccentricities and inclinations in the perturbing function were then introduced. In a second approximation, the contribution of the short period terms which provide the perturbations of the first order with respect to the masses was taken into account. Special attention was given to the problem of determining the integration constants. This work displays the relative importance of the different contributions -- it is useless to introduce the long period terms of fifth order if the short period terms are not taken into account. The major contributions were included; the neglected terms would not modify the integration constants materially. Author

N76-34091*# Scientific Translation Service, Santa Barbara, Calif.
MAGNETIC FIELDS OF PULSARS AND AN EVOLUTIONARY SCHEME FOR THE FORMATION OF RADIOPULSARS IN BINARY SYSTEM
G. S. Bisnovatyy-kogan and B. V. Komberg Washington NASA Oct. 1976 18 p refs Transl. into ENGLISH of "Magnitnyye Polya Pul'sarov i Evolyutsionnaya Skhema Obrazovaniya Radiopul'sara v dvoynoy sisteme", Rept. Pr-269 Moscow, 1976 p 1-22
(Contract NASw-2791)
(NASA-TT-F-17258) Avail: NTIS HC $3.50 CSCL 03B

An analysis of data showing the absence of radio pulsars in binary and evolutionary systems is presented. It was assumed that the magnetic field of a neutron star is damped by 1-2 orders of magnitude, if the neutron star were at the stage of a roentgen pulsar. A scheme is proposed for the evolution of stars in close binaries. Author

N76-34092# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
TIME DOMAIN ANALYSIS OF A ONE-DIMENSIONAL RESONATOR WITH APPLICATION TO THE GRAVITATIONAL ANTENNA
G. V. Pallottino Sep. 1975 50 p refs
(LPS-75-29) Avail: NTIS HC $4.00

The electromechanical Maxwell analogy is discussed that relates the behavior of the antenna with that of an electrical line. It is shown in particular how the force-strain characteristic of the antenna can be derived from the floating voltage-to-voltage characteristic of the line. From the impulsive response obtained with time domain considerations, the transfer function of the antenna was obtained by Laplace transformation, and an explicit expression is given for the overall transfer function from the gravitational wave to the strain. The one-dimensional analysis allows the distributed properties of the antenna to be exploited. Multiple sensors placed in different locations on the antenna allow it to be used as a spectrum analyzer and with correlation methods for increasing the signal to noise ratio. Author (ESA)

N76-34093# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
[RESEARCH ACTIVITIES IN THE SPACE PLASMA FIELD] Annual Report, 1975 [RELAZIONE SULL'ATTIVITA SVOLTA NELL ANNO 1975]
Mar. 1976 59 p refs In ITALIAN
(LPS-76-8) Avail: NTIS HC $4.50

Research activities in the field of cosmic rays, interplanetary plasmas and magnetic fields, infrared radiation, and electrophysics of the atmosphere are reported. Other activities include international cooperation with American and European institutes for the realization of a liquid helium cooled infrared telescope onboard Spacelab, Helios 1 magnetic field data processing, and Helios 2 experiment on interplanetary magnetic fields. ESA

N76-34094# Loughborough Univ. of Technology (England). Dept. of Mathematics.
COLLIDING NEUTRINO FIELDS IN GENERAL RELATIVITY
J. B. Griffiths Aug. 1975 17 p refs
(MATHS-Res-75) Avail: NTIS HC $3.50

The neutrino field equations are given in Newman-Penrose formalism, and an exact solution of the Einstein-neutrino equations was obtained which describes the collision and subsequent interaction of two neutrino fields. The gravitational interaction of the two fields was found to be completely different from that between two similar electromagnetic fields. Author (ESA)

N76-34095# Oxford Univ. (England). Engineering Lab.
INERTIAL EFFECTS IN THE CO-ROTATING ZONES OF PULSAR MAGNETOSPHERES
R. Buckley 1975 18 p refs
(OUEL-1140/75) Avail: NTIS HC $3.50

A class of models was constructed of the inner, corotating zones of pulsar magnetospheres. Particle inertia was included by constructing distribution functions in terms of an exact constant of the particle motion. The precise form of the distributions need not be specified. Inertia manifests itself close to the neutron star surface where there is a thin sheath in which significant values of E11 may occur. It is possible to specify the densities of both species arbitrarily on the surface. The potential drop across this sheath then adjusts the net charge density to such a value that, in the body of the magnetosphere, the inertialess models considered by other authors are approached. The model breaks down close to the light cylinder through the appearance of unbounded centrifugal forces. The source of these is traced to the restrictions placed on the distribution functions; methods of obviating them are suggested. Author (ESA)

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N76-34096*# Kanner (Leo) Associates, Redwood City, Calif.
PRELIMINARY RESULTS OF NARROW-BAND PHOTOMETRIC SOUNDING OF THE VENUS CLOUD LAYER IN THE 0.80 - 0.87 MICROMETER SPECTRAL BAND ON THE VENERA-9 AND VENERA-10 DESCENT VEHICLES
V. I. Moroz, N. A. Parfentyev, N. F. Sanko, V. S. Zhegulev, L. N. Zasova, and Ye. A. Ustinov Washington NASA Oct. 1976 39 p refs Transl. into ENGLISH of Acad. Sci. USSR, Inst. Space Res. (Moscow), Report Pr-272, 1976 p 1-40
(Contract NASw-2790)
(NASA-TT-F-17235) Avail: NTIS HC $4.00 CSCL 03B

Identical photometers aboard the Venera 9 and 10 descent probes measured atmosphere-scattered solar radiation in the 60 to 34 km altitude interval, in 3 narrow (approximately 50 A) spectral segments, 8700 A (CO2 band), 8200 A (H2O band), and 8000 A (continuum). Scattered continuum solar radiation intensity gradually decreases with decrease in altitude, with considerable fluctuations connected with cloud structure. The CO2 and H2O band absorption increases sharply below 40 km. A model of the scattering medium structure is proposed based on the results. Author

N76-34097*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
OPTICAL GUIDANCE VIDICON TEST PROGRAM Final Report
Allan R. Eiseman, Richard H. Stanton, and Charles C. Voge 15 Sep. 1976 68 p refs
(Contract NAS7-100)
(NASA-CR-148834; JPL-TM-33-796) Avail: NTIS HC $4.50 CSCL 03B

A laboratory and field test program was conducted to quantify the optical- navigation parameters of the Mariner vidicons. A scene simulator and a camera were designed and built for vidicon tests under a wide variety of conditions. Laboratory tests characterized error sources important to the optical navigation process and field tests verified star sensitivity and characterized comet optical guidance parameters. The equipment, tests and data reduction techniques used are described. Key test results are listed. A substantial increase in the understanding of the

use of selenium vidicons as detectors for spacecraft optical guidance was achieved, indicating a reduction in residual offset errors by a factor of two to four to the single pixel level. Author

N76-34098# Oak Ridge National Lab., Tenn.
REACTIONS OF ATMOSPHERIC VAPORS WITH LUNAR SOIL
E. L. Fuller, Jr. and P. A. Agron Mar. 1976 78 p refs
(Contract W-7405-eng-26)
(ORNL-5129) Avail: NTIS HC $5.00

Inert vapor adsorption was employed to measure the surface properties and changes wrought in the hydration-dehydration of lunar fines. Plausible mechanisms were considered and the predominant process involves hydration of the metamict metallosilicate surfaces to form a hydrated laminar structure akin to terrestrial clays. Additional credence for this interpretation is obtained by comparison to terrestrial weathering of primary metallosilicates. The surface properties of the hydrated lunar fines are compared favorably to those of terrestrial clay minerals. In addition, experimental results are given to show that fresh disorded surfaces of volcanic sand react with water vapor in a manner virturally identical to the majority of the lunar fines. The results show that ion track etching and/or grain boundary attack are minor contributions in the weathering of lunar fines in the realm of our microgravimetric experimental conditions. Author (NSA)

N76-34099# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
THE ISOTOPIC COMPOSITION OF LITHIUM, POTASSIUM, AND RUBIDIUM IN SOME APOLLO 11, 12, 14, 15, AND 16 SAMPLES Final Report
Ernest L. Garner, Lawrence A. Machlan, and I. Lynus Barnes 1975 13 p refs Repr. from Geochim. Cosmochim. Acta (England), v. 2, Suppl. 6, 1975 p 1845-1855 Presented at the 6th Lunar Sci. Conf., Houston, Tex., 17-21 Mar. 1975
(PB-252398/3) Avail: NTIS HC $3.50 CSCL 03B

The relative isotopic composition of lithium and the absolute composition of potassium and rubidium were determined in seven lunar soil and five lunar rock samples by solid sample, thermal ionization, mass spectrometry. Special precautions were taken to minimize the effect of impurities and variable sample size on the isotopic measurements. Relative to a natural reference standard of terrestrial material, the average 6Li/7Li of the lunar samples were found to be 1.0007 + or - 0.0027 (ts). The 85Rb087Rb average value is 2.5923 + or - 0.0043. Depletions of 0.3-0.8% were found in the 39K/41K ratios of five soils and one rock sample. Presently available data are insufficient to decipher the mechanism for potassium isotopic fractionation.
GRA

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N76-34100# Lund Observatory (Sweden).
BLOCKING EFFECTS OF SOLAR ABSORPTION LINES
A. Ardeberg and B. Virdefors 1976 41 p refs
(Rept-9) Avail: NTIS HC $4.00

A detailed survey was made of the blocking effects of solar absorption lines for the region lambda lambda 4300-6200. Line blocking coefficients are given for 1A intervals. Reduction was made for influence of telluric lines, the results of which are tabulated. Blocking coefficients are also given for the wave length intervals of Oke. The solar spectrum was surveyed for intervals favorable for continuum determinations with pass bands of 1A and 10A. Author

N76-34101# Lund Observatory (Sweden).
AN ATTEMPT TO MEASURE RESONANCE POLARIZATION IN THE 30 JUNE 1973 FLASH SPECTRUM
Tord Hanson, Bjoern Stenholm, and Staffan Soederhjelm 1976 17 p refs
(Rept-8) Avail: NTIS HC $3.50

An objective prism spectrograph with a polarization detection system was used to observe the Ca II H and K lines in the flash spectrum of the solar eclipse of June 30, 1973. Due to adverse circumstances, only a short and faint emission arc could be photographed. The sensitivity of the method did only allow a 5% upper limit to be set on the K line polarization, but at least in principle the observation technique was found to work.Author

N76-34102# Lund Observatory (Sweden).
LENAP: A COMPUTER PROGRAM FOR THE CALCULATION OF RESONANCE-LINE POLARIZATION
Lars Stenholm 1975 49 p refs
(Rept-7) Avail: NTIS HC $4.00

Polarization in spectral lines can be used as an additional observational parameter when studying the structure of stellar atmospheres. A computer program for the calculation of resonance-line polarization is described. This program was used to calculate the polarization in two solar UV emission lines. The program is written for lines formed in the chromosphere-corona transition region in the case of a two-level model atom, but can be modified to treat more general cases. Author

N76-34103*# Joint Publications Research Service, Arlington, Va.
SOLAR FLARES
A. B. Severnyy and N. N. Stepanyan Washington NASA Sep. 1976 47 p Transl. into ENGLISH of Kosmonavtika Astron. (Moscow), no. 6, 1976 p 1-63
(NASA Order W-13183)
(NASA-TT-F-17217) Avail: NTIS HC $4.00 CSCL 03B

Contemporary ideas about the processes taking place on the sun during flares are presented, and the general laws of their origin and development and also the spectral and other characteristics and the connection of flares with magnetic fields on the sun are examined. Special attention is given to the effect of solar flares on the earth's atmosphere and magnetosphere and on the human organism. Author

N76-34104*# TRW Systems Group, Redondo Beach, Calif. Dept. of Space Sciences.
ENERGIES OF BACKSTREAMING PROTONS IN THE FORESHOCK
Eugene W. Greenstadt May 1976 14 p refs
(Contract NASw-2877)
(NASA-CR-147981; TRW-29506-6002-RU-00) Avail: NTIS HC $3.50 CSCL 03C

A predicted pattern of energy vs detector location in the cislunar region is displayed for protons of zero pitch angle traveling upstream away from the quasi-parallel bow shock. The pattern is implied by upstream wave boundary properties. In the solar ecliptic, protons are estimated to have a minimum of 1.1 times the solar wind bulk energy E sub SW when the wave boundary is in the early morning sector and a maximum of 8.2 E sub SW when the boundary is near the predawn flank. Author

N76-34105# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
EVIDENCE FOR MAGNETIC FIELD LINE RECONNEXION IN THE SOLAR WIND
V. Formisano, E. Amata (Imperial Coll. of Sci. and Technol.), P. C. Hedgecock (Imperial Coll. of Sci. and Technol.), C. T. Russell (Calif. Univ., Los Agneles), and J. Means (Calif. Univ., Los Angeles) Sep. 1974 25 p refs
(LPS-74-23) Avail: NTIS HC $3.50

Reconnection of magnetic field lines of force in the solar wind was studied using HEOS-1 and OGO-5 data. The reconnection models of Petscheck, Yeh and Axford, and Sonnerup are discussed. Four observations of structures related to large change of magnetic field directions (days 36, 260 and 306, 1969 HEOS-1 data; day 64, 1969 OGO-5 data) are presented. The reconnection rate reached with the Petscheck model appears to be higher than previously estimated. The observed geometry agrees with the Petscheck model and the scale length in the solar wind is 5,000 to 100,000 km. Structures such as those predicted by Sonnerup and by Yeh and Axford were not observed within the scale lengths of the two models. ESA

N76-34106# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
SOLAR WIND INTERACTION WITH THE EARTH'S MAG-

NETIC FIELD. PART 4: THE KNOWING REGION
V. Formisano and E. Amata (Imperial Coll. of Sci. and Technol.) Feb. 1975 31 p refs
(LPS-75-1-Pt-4) Avail: NTIS HC $4.00

The interaction of the incoming solar wind protons with particles reflected at the bow shock was studied with HEOS-1 plasma and magnetic field data: the proton bulk speed was found to decrease by 30 km/sec in the region where upstream waves are observed (knowing region). The wave amplitude was found to increase with increasing bulk speed and to decrease with increasing proton number density. Author (ESA)

N76-34107# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
LATITUDINAL STRUCTURE OF THE SOLAR WIND AND INTERPLANETARY MAGNETIC FIELD
M. Dobrowolny and G. Moreno May 1975 129 p refs
(LPS-75-17) Avail: NTIS HC $6.00

The experimental information on latitude effects in the solar wind plasma, obtained from both direct measurements and, indirectly, from observations of comet tails and radio scintillations, is reviewed. Magnetic field observations, notably of the polar magnetic field and of the semiannual variation of the geomagnetic activity, are reported. Theoretical models of latitudinal effects in the solar wind are outlined; three-dimensional solar wind models and studies of gas-magnetic field interactions are considered. The results of such models are reported in detail for different types of coronal boundary conditions, both uniform and non-uniform. The predictions of the theoretical models are compared with the available experimental knowledge on latitudinal structures of the solar wind plasma and the interplanetary magnetic field. ESA

N76-34108# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 379. PART 1: PROMPT REPORTS; DATA FOR JANUARY - FEBRUARY 1976. EXPLANATION OF DATA REPORTS ISSUED AS NUMBER 378 (SUPPLEMENT) FEBRUARY 1976
Hope I. Leighton Mar. 1976 119 p
(PB-247137-379-1; SGD-379-Pt-1; NOAA-76041301-Pt-1) Avail: NTIS MF $2.25; HC available from National Climatic Center, Attn: Publications, Federal Bldg., Asheville, N. C. 28801. Subscription $34.00/year includes part 1 (Prompt Reports) and part 2 (Comprehensive Reports); $18.00/year for either part. Annual supplement containing explanation is included. $1.50/copy for either part; $1.40 for the extra issue CSCL 03B

Predicted and observed solar and geophysical data are presented in tables and graphs. The data include sunspot numbers, solar flux, solar flares and their effects, magnetic storms, and SID effects. Author

N76-34109# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 379. PART 2: COMPREHENSIVE REPORTS; DATA FOR AUGUST - SEPTEMBER 1975 AND MISCELLANEA. EXPLANATION OF DATA REPORTS ISSUED AS NUMBER 378 (SUPPLEMENT) FEBRUARY 1976
Hope I. Leighton Mar. 1976 26 p
(PB-247137-379-2; SGD-279-Pt-2; NOAA-76041301-Pt-2) Avail: NTIS MF $2.25; HC available from National Climatic Center, Attn: Publication, Federal Bldg., Asheville, N. C. 28801. Subscription $34.00/year includes part 1 (Prompt Reports) and part 2 (Comprehensive Reports); $18.00/year for either part. Annual supplement containing explanation is included. $1.50/copy for either part; $1.40 for the extra issue CSCL 03B

For abstract, see N76-34108.

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N76-34110*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NO NEW LIMIT ON THE SIZE DISTRIBUTION OF GAMMA-RAY BURSTS
T. L. Cline and W. K. H. Schmidt Oct. 1976 9 p refs Submitted for publication
(NASA-TM-X-71205; X-661-76-222) Avail: NTIS HC $3.50 CSCL 03C

The results of a study (Carter et. al.) of gamma ray bursts using long duration balloon exposure are analyzed. Arguments are presented against the conclusion that the size spectrum extrapolates to a power law with index from -1.0 to -0.5, and that therefore the gamma ray bursts are of galactic origin. It is claimed that the data are consistent with an upper limit over 100 times that proposed, and that therefore no conclusion can be drawn from the measurements regarding the nature or origin of gamma ray bursts. The resulting upper limit to the rate of occurrence of small bursts lies above the -1.5 index power law extrapolation of the size spectrum of known events, i.e., greater than the rate expected from an infinitely extended source region. D.M.L.

N76-34111*# Lockheed Missiles and Space Co., Palo Alto, Calif.
ANALYSIS OF HIGH RESOLUTION SATELLITE DATA FOR COSMIC GAMMA RAY BURSTS Final Report
W. L. Imhof, G. H. Nakano, and J. B. Reagan 9 Jun. 1976 73 p refs
(Contract NASw-2861)
(NASA-CR-147982; LMSC-D502690) Avail: NTIS HC $4.50 CSCL 03B

Cosmic gamma ray bursts detected a germanium spectrometer on the low altitude satellite 1972-076B were surveyed. Several bursts with durations ranging from approximately 0.032 to > 15 seconds were found and are tabulated. The frequency of occurrence/intensity distribution of these events was compared with the S to the -3/2 power curve of confirmed events. The longer duration events fall above the S to the -3/2 power curve of confirmed events, suggesting they are perhaps not all true cosmic gamma-ray bursts. The narrow duration events fall closely on the S to the -3/2 power curve. The survey also revealed several counting rate spikes, with durations comparable to confirmed gamma-ray bursts, which were shown to be of magnetospheric origin. Confirmation that energetic electrons were responsible for these bursts was achieved from analysis of all data from the complete payload of gamma-ray and energetic particle detectors on board the satellite. The analyses also revealed that the narrowness of the spikes was primarily spatial rather than temporal in character. Author

N76-34112# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
MEASUREMENT OF THE DIFFUSE ATMOSPHERIC AND COSMIC GAMMA RADIATION IN THE ENERGY RANGE 1-10 MeV WITH A BALLOON-BORNE COMPTON TELESCOPE [MESSUNG DER DIFFUSEN ATMOSPHAERISCHEN UND KOSMISCHEN GAMMA-STRAHLUNG IM ENERGIEBEREICH 1-10 MeV MIT EINEM BALLONGETRAGENEN COMPTON-TELESKOP]
Giselher Lichti Jul. 1975 114 p refs In GERMAN
(MPI-PAE-Extraterr-110) Avail: NTIS HC $5.50

The operation and the construction of a Compton telescope for the low energy gamma range are reported. The energy resolution of the telescope is 30% for about 1 MeV, its angular resolution plus or minus 20 deg. Notwithstanding its low detection probability of about 0.5%, the vertical gamma quantum flux could be measured, and the extragalactic origin of the diffuse components of the cosmic gamma radiation could be indicated during two balloon flights.

N76-34113# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
SEARCH FOR LONG TERM VARIATIONS OF THE INTERPLANETARY MAGNETIC FIELD: SOLAR CYCLE AND HELIOGRAPHIC LATITUDE VARIATIONS IN THE YEARS 1964 TO 1972
F. Mariani, L. Diodato, and G. Moreno Nov. 1974 37 p refs
(LPS-74-29) Avail: NTIS HC $4.00

A statistical study was made of the long term variations of the interplanetary magnetic field parameters collected in the years 1964 to 1972 by 13 spacecraft (IMP'S, Pioneers, and HEOS). Although temporal fluctuations were observed on field components and magnitudes, no clear solar cycle variation was found. The same conclusion holds for the statistical distributions and variances of these parameters. A search for possible heliographic latitude effects on the field also led to a negative conclusion.
Author (ESA)

N76-34114# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
INTERPLANETARY SHOCK WAVES OF THE FAST, SLOW AND SWITCH TYPES
V. Formisano, G. Mastrantonio, and P. C. Hedgecock Apr. 1975 38 p refs
(LPS-75-8) Avail: NTIS HC $4.00

Plasma and magnetic field data from HEOS-1 were used to identify interplanetary shocks. During the periods from Dec. 1968 to April 1969 and from Sept. 1969 to Dec. 1969, 19 events were obtained. Among the observed events of the fast and slow type, two switch-on and four switch-off shocks were identified. Such types of shock have never been previously reported. The study of a particular case of a switch-off shock (for which data of 4 satellites were available) led to the conclusion that switch-off shocks are stable at least for periods of about half an hour. Moreover, the study of the complex structure of a sector-boundary revealed the existence of two switch-off shocks associated with two fast shocks (forward and reverse); such a structure suggests that switch shocks can be generated in connection with the magnetic field reconnection phenomena. Author (ESA)

N76-34115# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
COSMIC RAY NM-64 NEUTRON MONITOR DATA-2, ROME, JANUARY - DECEMBER 1973
G. Villoresi, N. L. Zangrilli, M. Parisi, M. Storini, A. Felici, and F. Signoretti Apr. 1975 35 p refs
(LPS-75-9) Avail: NTIS HC $4.00

Pressure-corrected data from the Rome neutron monitor and barometric pressure data are given in tabular form, together with the graphs of the corrected intensity. Details on the devices employed, operational mode, and data handling are given.
Author (ESA)

N76-34116# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
MAGNETIC FIELD MEASUREMENTS BY PIONEER 8. PART 2: HOURLY AVERAGES OF THE FIELD ELEMENTS FROM 8 DEC. 1968 - 20 DEC. 1969 (BARTELS' SOLAR ROTATION 1852 TO 1865)
F. Mariani, Norman F. Ness, and C. Irace Apr. 1975 36 p refs
(LPS-75-13-Pt-2) Avail: NTIS HC $4.00

The magnetic field data in the solar ecliptic reference system are presented in graphical form. Hourly averages of field intensities, latitude and longitude of the field vector, and variances are shown for Bartel's solar rotation from 1852 to 1865. ESA

N76-34117# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
NEUTRAL SHEET OBSERVATIONS AT 1,000 EARTH RADII
U. Villante May 1975 20 p refs
(LPS-75-19) Avail: NTIS HC $3.50

A detailed analysis of magnetic field observations internal to the field reversal regions suggests the presence, at about 1,000 earth radii (Pioneer 7), of a well defined neutral sheet still preserving most of its earth characteristics. The normal direction to the rotation plane of the magnetic field vector is consistent with an aberrated tail model. Observed large values of the reconnection component, occasionally southward, at the reversal point might be interpreted in terms of closed loops of opposite field lines. Order of magnitude estimates of the sheet dimensions confirm a sheet thickness of 0.1 to 1 earth radii.
Author (ESA)

N76-34118# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
[RESEARCH ACTIVITIES IN THE SPACE PLASMA FIELD] Annual Report, 1974 [RELAZIONE SULLA ATTIVITA SVOLTA NELL ANNO 1974]
Jun. 1975 51 p refs In ITALIAN
(LPS-75-21) Avail: NTIS HC $4.50

Activities in the field of cosmic rays, interplanetary plasmas, magnetic fields, electronics and gravitational fields, the infrared radiation, and electrophysics of the atmosphere are reported. Research and development of long term programs, seminars held at the Laboratory, working groups, and theses and reports published in 1974 are listed. ESA

N76-34119# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
DESIGN OF AN AUTOMATIC STATION FOR COSMIC RAY STUDIES (SVIRCO) [PROGETTO DI AUTOMAZIONE DELLA STAZIONE PER LO STUDIO DEI RAGGI COSMICI S.V.I.R. CO.]
G. Vannaroni Sep. 1975 26 p refs In ITALIAN
(LPS-75-27) Avail: NTIS HC $4.00

The design of a data processing station for study of periodic variations of the intensity of the primary cosmic ray nucleonic component with a 6.3 6V threshold was investigated, together with selection criteria and solutions for the configuration of the data transmission system electronic circuits. Main features of the SVIRCO station, including nine proportional counters as particle detector, a clock as timing device, a counting unit, magnetic tapes, a multiplexer, and auxiliary system, are described. ESA

N76-34120# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
COSMIC RAY NM-64 NEUTRON MONITOR DATA-3, ROME, JANUARY - DECEMBER 1974
G. Villoresi, N. L. Zangrilli, M. Parisi, M. Storini, A. Felici, and F. Signoretti Oct. 1975 35 p refs
(LPS-75-34) Avail: NTIS HC $4.00

Pressure corrected data from the Rome neutron monitor and barometric pressure data are given in tabular form together with the graphs of the corrected intensity. Details on the devices employed, operational mode, and data handling are given.
Author (ESA)

N76-34121# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
LATITUDE CURVES OF THE DAILY NUCLEONIC INTENSITY AT SEA-LEVEL FROM 1957 TO 1965
N. Iucci, G. Villoresi, and N. L. Zangrilli Nov. 1975 115 p refs
(LPS-75-35) Avail: NTIS HC $5.50

A set of daily latitude curves was obtained by an indirect calibration procedure for practically the whole network of the near-sea-level neutron monitors by means of seven latitude surveys performed by ship or by terrestrial vehicle. These curves, shown in tabular form, are particularly suitable for studying the isotropic part of the primary cosmic ray spectral variation.
Author (ESA)

99 GENERAL

N76-34122+ Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Karlsruhe (West Germany). Inst. fuer Systemtechnik und Innovationsforschung.
PUBLISHED PATENT APPLICATIONS AND PATENTS IN THE FIELD OF GOVERNMENT-SPONSORED TECHNOLOGICAL RESEARCH AND DEVELOPMENT Final Report
Gerhard Jaeckel, comp. and Herta Zimmermann, comp. Bonn Bundesmin. fuer Forsch. u. Technol. Apr. 1976 284 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-76-23) Avail: NTIS HC $9.25; ZLDI, Munich, DM 59.45

A compilation is presented of patent applications and patents generated by industry from German government-sponsored research and developent projects. The years 1969 to 1972 are covered, and indexes are provided. ESA

E5108